Applied Hydraulics

PNEUMATICS · ELECTRICAL CONTROLS

MAY 1958

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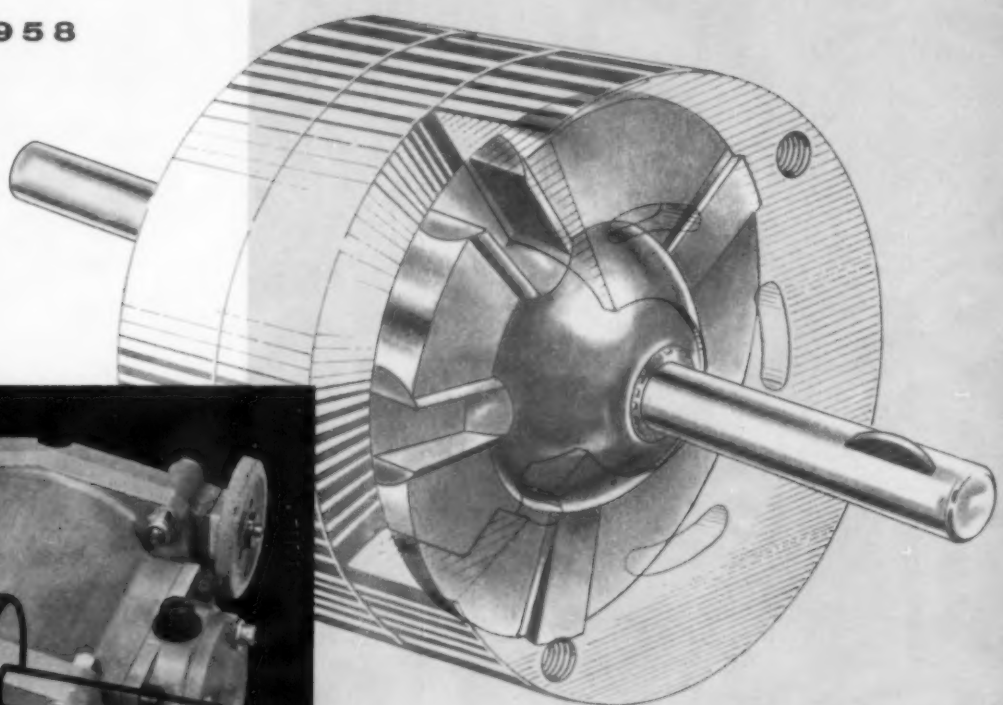

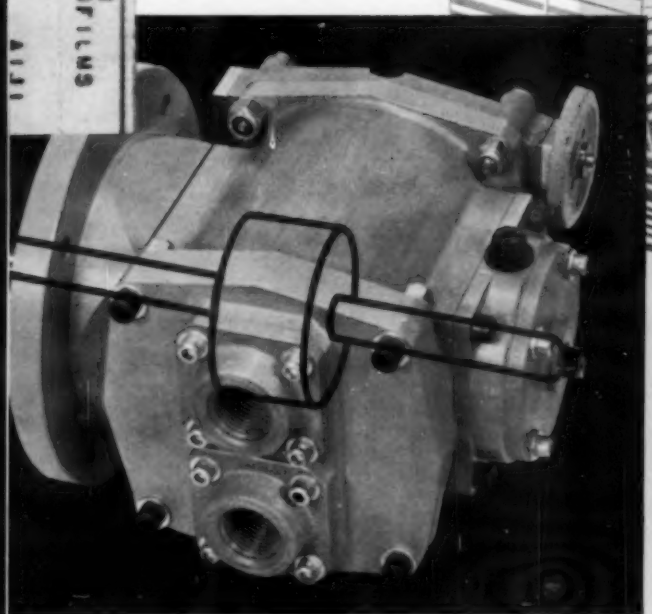

New pump design promises low weight per horsepower

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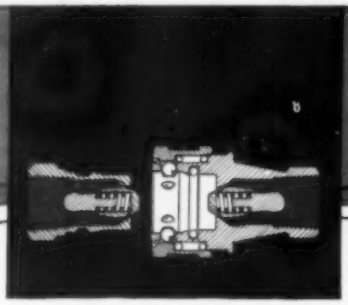
THE MAGAZINE OF FLUID POWER

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

1958 Fluid Power Contest
CLOSES JULY 1st
For Complete Information, See Page 157



shuts off both sides of line... prevents loss of liquid, gas, or pressure.

Wherever 2-way shut-off is required...

HANSEN

QUICK-CONNECTIVE TWO-WAY SHUT-OFF COUPLINGS

FOR PRESSURE OR VACUUM SERVICE

To connect a Hansen Two-Way Shut-Off Coupling, you merely pull back the sleeve and push the Plug into the Socket. To disconnect, just pull back the sleeve. No tools required. When Coupling is disconnected, similar valves in Socket and Plug shut off both ends of line—practically eliminate spilling of liquid or escape of gas at instant of disconnection.

Hansen Series HK Two-Way Shut-Off Couplings are available with female pipe thread connections from ⅛" to 1" inclusive. Available in brass or steel. Sizes generally required for L-P Gas service have approval of Underwriters' Laboratories.

WRITE FOR THE HANSEN CATALOG

Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes of Hansen One-Way Shut-Off, Two-Way Shut-Off, and Straight-Through Couplings—including Special Service Couplings for Steam, Oxygen, Acetylene, etc.

REPRESENTATIVES IN PRINCIPAL CITIES

SINCE 1915 — QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

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CIRCLE 55 ON READER SERVICE CARD

CONTROL FLUID FLOW

with Micrometer Accuracy

HANNA *Flo-Set* VALVES

For AIR, OIL and WATER operation to 250 p. s. i.
SIZES ¼" · ⅜" · ½" · ¾"
TEMPERATURES to 250°F

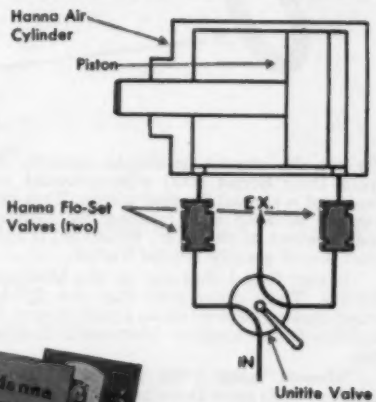
Hanna Flo-Set Valves are used to control cylinder piston speeds and operating speeds of many types of fluid actuated mechanisms. They are able to handle air, oil, water and many gases. When used with cylinders, these valves permit independent adjustments of forward and return piston speeds. The diagram at the right shows a typical circuit. Flo-Set Valves make the operation of air cylinders smoother and make cushioned cylinders more effective by building up essential back pressure.

Fluids pass unobstructed in the direction of the arrow on Hanna Flo-Set Valves. In the opposite direction, flow can be controlled from zero to full pipe capacity. One valve can be set to an infinite number of controlled flow positions. Once set, the position can be held by means of a locking collar. Established flow positions can be reset by using the micrometer graduations which accurately measure flow as a percent of full pipe capacity.

One revolution of the aluminum valve body will change the flow rate from zero to full capacity. No tools are necessary! In addition to the standard ¼", ⅜", ½" and ¾" sizes, there is a ¼" Jr. model, without micrometer graduations or locking collar, for light piping and tubing.

Typical Cylinder Circuit Using Hanna Flo-Set Speed Control Valves

Hanna engineers will gladly recommend circuits to help you with your applications.



Consult your classified telephone directory or Thomas' Register for your nearest Hanna representative. Write for Hanna Valve Catalog 254 and Flo-Set Valve Bulletin 253A.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

1741 Elston Avenue • Chicago 22, Illinois

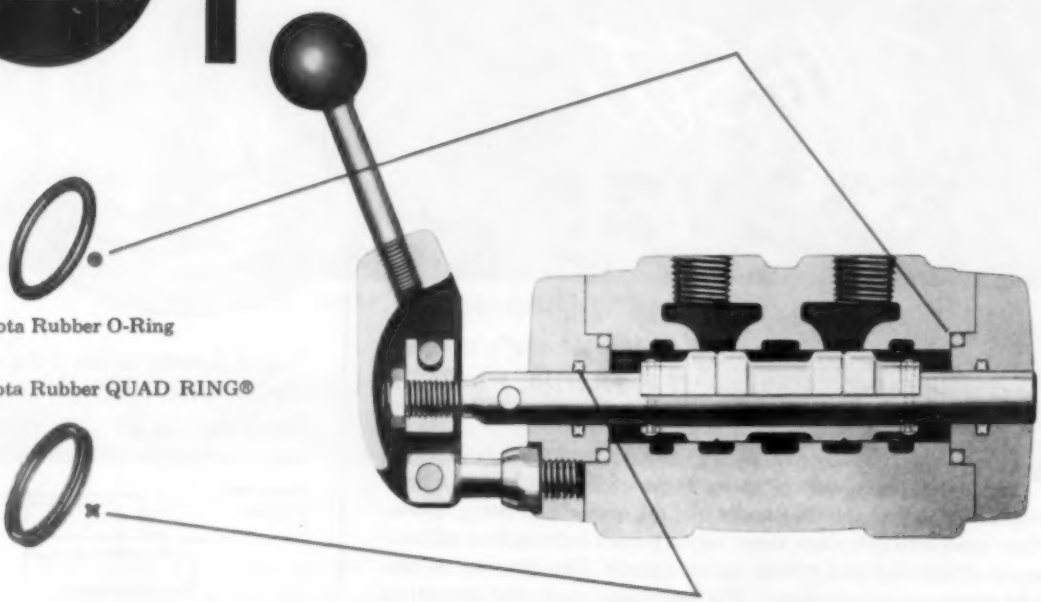
CIRLCE 53 ON READER SERVICE CARD

hydraulics problem:

to improve operation of a pipe-mounted valve

problem solved by:

QUAD RINGS® and O-rings from minnesota rubber



Minnesota Rubber O-Ring

Minnesota Rubber QUAD RING®

To get the utmost in simple, smooth, leakproof operation from their Series 5000 pipe-mounted valve, Rivett, Inc., designed a special floating piston. This exclusive feature prevented sticking and binding by keeping the valve stem independent of the bore. However, it called for a stem seal that would greatly reduce friction.

Rivett found that seal in the Minnesota Rubber QUAD RING. They discovered that the QUAD RING required much less squeeze to make a perfect seal. The hydraulic valve makers found another Minnesota Rubber Product helpful, too.

Minnesota Rubber O-Ring cover seals eliminated and replaced gaskets. This gave three advantages: design simplicity, more efficient operation and longer life.

In fact, this combination of advanced design elements and Minnesota Rubber seals permits multi-million cycle operation at 1500 PSI.

The QUAD RING gives you 4-lip sealing action at less than 1 PSI. The QUAD RING requires only 60-100 micro-inch groove finish and eliminates spiral twist. An exclusive injection molding process makes Minnesota Rubber QUAD RINGS, O-Rings and other rubber parts denser and tougher than standard molded parts.

O-Rings from Minnesota Rubber are available with tolerances as close as ±.002". They cost as little as ordinary O-rings, yet are produced with no flash or other imperfections that require trimming. They are available in a broad range of standard sizes. Special sizes or compounds available on order. For full details on the O-Ring and QUAD RING, write to the department and address listed below. A 16-page facilities brochure is also available upon request.

Need low-cost prototypes? Another technique pioneered by Minnesota Rubber is KOTOCAST. This technique means rapid delivery of prototypes for experiment and development at a cost far below those made by standard processes. PROTOTYPES by KOTOCAST . . . another step forward by Minnesota Rubber Company.

Note: KOTOCAST is a trademark of the Minnesota Rubber Company.

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for color in rubber
for parts of silicone rubber
for versatility in rubber
for applied product development

MINNESOTA MR RUBBER

Rainbow Division
Silicone Division
Plastic and Latex Division
Research Division

CIRCLE 79 ON READER SERVICE CARD

Applied Hydraulics

VOLUME 11/NUMBER 5

MAY 1958 THE MAGAZINE OF FLUID POWER

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Keep YOUR HYDRAULIC SYSTEM Clean with HILCO HYDRAULIC OIL FILTER

- No More Varnish and Sludge Deposits
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- No More Frequent Oil Changes
- No More Accumulation of Dirt

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HILCO Hyflow Oil Filters trap dirt, acids, rust, sludge, gums, resins . . . all solid contaminants, and keeps your hydraulic system clean and in top running condition at all times. To you, this means longer oil life, reduced wear and abrasion . . . hence, less down time and lower maintenance costs giving you continuous equipment operation with increased production. Hydraulic unit sensitivity depends upon a clean system. HILCO Hyflow filters remove solids as soon as they enter the system and retain much of the moisture which enters the oil from the atmosphere and from condensation. Obtain the full capacity and economy of your equipment by keeping it in top running condition with HILCO. Hydraulic Oil Filters come in stationary or portable models. They can be hooked into hydraulic systems without interrupting equipment operation.

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IN CANADA:

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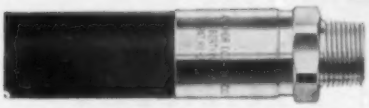
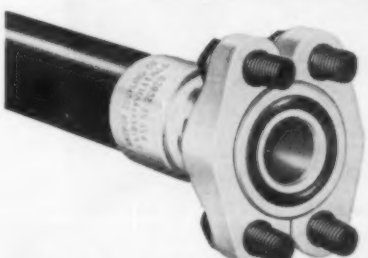


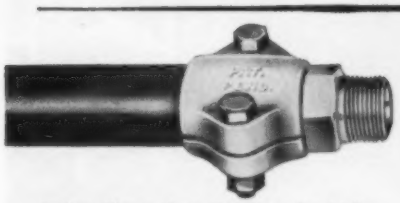
Anchor High, Medium and Low Pressure Hose Assemblies for Three, Two and One Wire Braid Hose, Two Rayon Braid Hose and Spiral Wire Suction Hose.

Anchor Adapter Unions, Pipe Fittings and SAE Boss Type Adapters.

Anchor Reusable Couplings for High, Medium and Low Pressure Hose.



Anchor Flanco 4-Bolt, Split-Flange "O"—Ring Couplings with Pressed On Couplings or Clamp Type Reusable Coupling.



Anchor Clamp Type Couplings for high, medium and low pressure.

Anchor L.P.G. Hose Assemblies with Pressed On or Reusable Couplings.

Anchor Automotive Hose Assemblies; Freon Hose Assemblies and Power Steering Hose Assemblies.

There is more than a decade of Research and Development behind these

HYDRAULIC HOSE ASSEMBLIES and FITTINGS!

Here is a complete line, one of the most comprehensive available anywhere today, including couplings, hose assemblies and fittings for any need in the transmission of fluid power.

The Anchor products shown have been developed and re-designed thru the past decade to keep abreast of the rapidly changing field of hydraulics, each style and size offering the most modern features with bonus value in application convenience and service life.

Catalogs are available for each product classification, each with a wealth of diagrams, tables and technical data that are available for your assistance in selecting just the hose assembly or coupling that is best for your particular application.

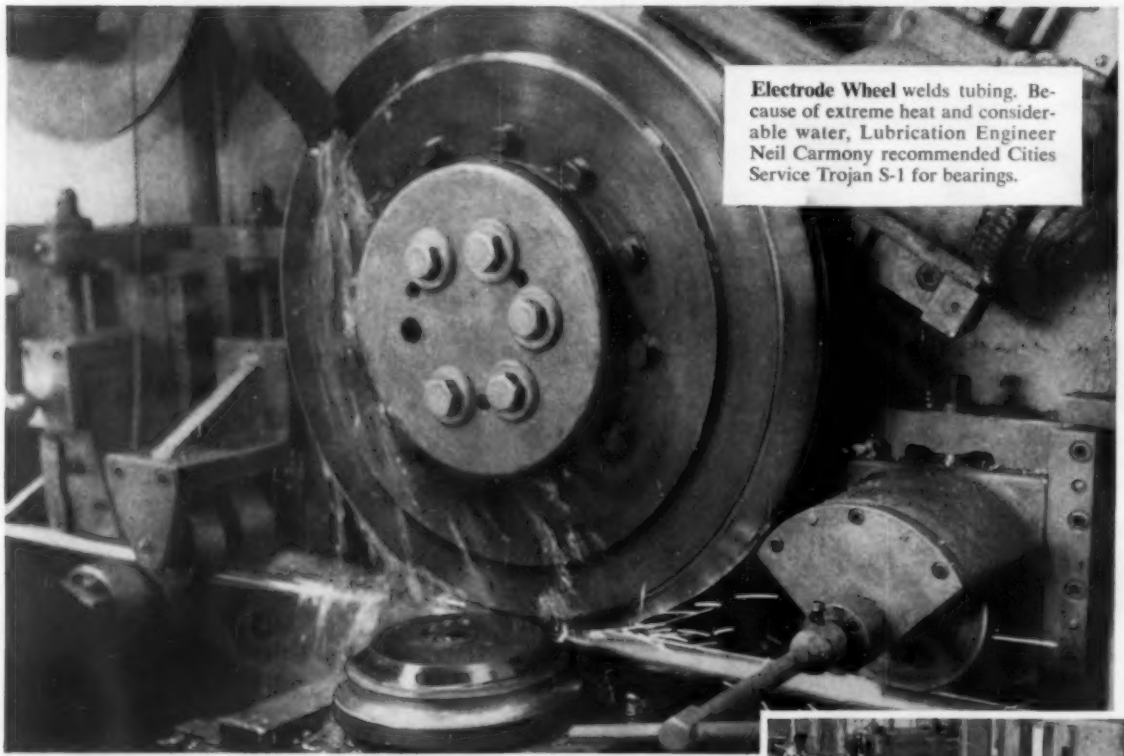
Andy Anchor says:

A general condensed catalog of the entire Anchor Line is also available. Ask for Catalog 57S.

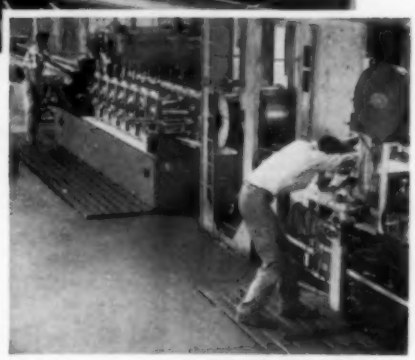
ANCHOR COUPLING CO. INC.

339 North Fourth Street, Libertyville, Illinois
Branch Offices: Dallas, Tex., Plymouth, Mich.

New Tubing Mill Produces at Speed of 350 Feet Per Minute!



Electrode Wheel welds tubing. Because of extreme heat and considerable water, Lubrication Engineer Neil Carmony recommended Cities Service Trojan S-1 for bearings.



It's Cities Service for Hydraulic System and all lubrication

On January 1, 1957, P&H Tube Corporation put a new mill in production at Bossier City, Louisiana—the only one of its kind in the United States.

Equipped with special drives and worm gears, this unique mill actually produces at the rate of 350 feet per minute—twice the speed of conventional tubing mills!

With speeds like this, you might expect lubrication troubles . . . but P&H Tube Corporation has none. One big reason is the careful study of each machine made by Cities Service Lubrication Engineer Neil Carmony—and the lubrication recommendations he made.

In hydraulic units, for example, Carmony recommended Pacemaker 200-T Hydraulic Oil . . . for he knew its ability to withstand the severest operating temperatures and speeds. He knew that due to its exceptionally high viscosity index and superior compounding, Pacemaker 200-T would give maximum resistance to thinning, oxidation, rust and corrosion.

The wisdom of this decision, as well as the choice of other lubricants shown in the chart at right, was demonstrated recently when P&H Tube Corporation ran off 125,000 feet of tubing in an ordinary eight hour shift—with normal time-out for change-overs!

That's production with a capital P! And if you'd like to improve your production picture, a Cities Service Lubrication Engineer can help you, too. Call the nearest office or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

What the Cities Service Lubrication Engineer Recommended

Hydraulic units	Pacemaker 200-T
Bearings	Trojan H-2 Grease
Drive units	Pacemaker Oils
Bearings by the mill's electrodes	Trojan S-1

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CIRCLE 23 ON READER SERVICE CARD

. . . Fluid Power news

REPORT No. 11,101

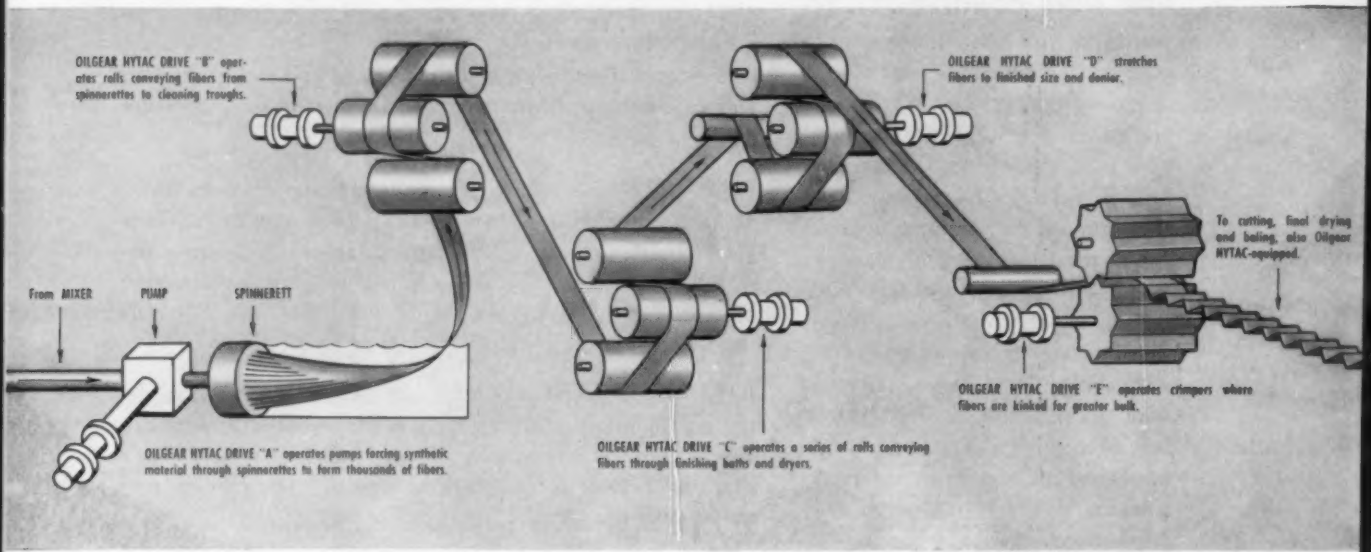
"HYTACS" SOLVE DRIVE PROBLEMS

From Oilgear Application-Engineering Files

HOW OILGEAR "HYTAC" DRIVES SYNCHRONIZE PROCESSING OF NEW SYNTHETIC FIBERS

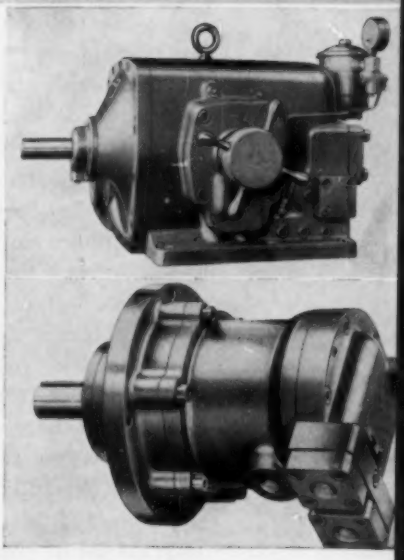
CUSTOMER: *A Producer of Synthetic Fiber (name withheld)*

DATA: Rotary machine drives for complete processing of a new synthetic fiber. User wishes to eliminate line shaft drive, and mechanical, variable speed drive components used in pilot plant due to limited, inaccurate speeds, slow speed changes, difficulty of synchronization. REQUIREMENTS: higher speeds and greater speed range; rapid speed changes; smooth, positive, accurate speed control and synchronization regardless of load variation down to ½ rpm; serviceable by non-technical personnel; safe for use in hazardous atmospheres; occupy minimum space; individual drive flexibility—for addition, removal, or separate operation; keep electrical power requirements to a minimum.


OILGEAR HYTAC DRIVE "B" operates rolls conveying fibers from spinnerettes to cleaning troughs.
OILGEAR HYTAC DRIVE "D" stretches fibers to finished size and denier.
To cutting, final drying and baling, also Oilgear HYTAC-equipped.
From MIXER
PUMP
SPINNERETT
OILGEAR HYTAC DRIVE "E" operates crimpers where fibers are kinked for greater bulk.
OILGEAR HYTAC DRIVE "A" operates pumps forcing synthetic material through spinnerettes to form thousands of fibers.
OILGEAR HYTAC DRIVE "C" operates a series of rolls conveying fibers through finishing baths and dryers.

SOLUTION: Oilgear "HYTAC" (hydraulic tachometer) "ANY-SPEED" drives are shown above as A, B, C, D, E, for each machine. After completion of the first installation by Oilgear personnel, user plant personnel installed, started, and adjusted the drives on the balance of the machines. Drives operate at different speeds during fiber processing, yet hold a pre-selected speed within ±0.5% regardless of load variation. Drive "D" is most critical, as any speed variation here results in changes in fiber diameter, wrong denier, and breakage. These Oilgear systems are completely sealed, flood-lubricated, and can be remotely controlled. USER REPORTS—dependable, continuous, full-load operation for weeks within pre-selected speed control limits; more than adequate speed and speed range with instant speed changes when required; no lag when starting several sections; electrical power consumption far below initial estimates; little reported maintenance in several years of continuous operation. Due to this outstanding performance record, this plant is 100% Oilgear-equipped—hundreds of Oilgear drive components are used.

For similar practical solutions to YOUR *linear or rotary drive problems, call the factory-trained Oilgear application-engineer in your vicinity. Or write, stating your specific requirements, directly to . . .*



Oilgear type "DR-2011" variable delivery (input drive) pump with hydraulic control supplies power to . . .

. . . an Oilgear type "H-2011" constant displacement (output drive) motors. Oilgear "HYTAC" precision, "Any-Speed" drives are available in 1 to 100 hp sizes.

Synchronization of multiple, tandem operations; combining separate operations to handle webs soft and fragile at one point—strong at another; or continuous webs where tension affects quality . . . all need more than conventional drives and controls . . . .
. . . they need Oilgear "HYTAC" precision, "Any-Speed" drives and controls.

THE OILGEAR COMPANY

Application-Engineered Fluid Power Systems

1564 WEST PIERCE STREET • MILWAUKEE 4, WISCONSIN

FLUID POWER LINES

about applied hydraulics

NEW PUMP CONCEPT . . . If you think you know the types of pumps used for fluid power systems—gear, vane, piston—you're in for a surprise when you read *New Pump Promises Low Weight Per Horsepower*. In studying out the pumping action, forget what you know about how pumps work, because this one has an entirely different principle than any you've seen before.

Frankly, first time around with John Houser's description left us arguing violently on what happened in that little rotor. A working model of the pump and further explanation from its designer cleared us up. Dick Zaleski of our art department worked out the drawing on the front cover to show the action.

Although this pump was developed for aircraft where its high ratios of delivery to size and weight are important, it also has advantages for industrial applications. Larger port openings permit higher speeds without starvation. This pump with a 15-inch diameter rotor, 8 inches wide would have a delivery of about 1000 gpm at 800 rpm, and could be designed for 2000 psi —predicted weight 3000 lb. That's a lot of power in a small package.

ALL ABOUT AIR . . . *Fluid Power* is a term which includes compressed air systems as well as hydraulics. This issue has three articles giving ideas for air system design and control. Understanding the circuits and electrical control on these applications will help you in your own designs.

100,000 RPM . . . Aircraft designers now talk nonchalantly about rotational speeds of 100,000 rpm to get high power from small units. As pump speeds increase, bearing design becomes more and more important. For a discussion of this by two leading engineers, read *Bearings For Aircraft Pumps* in this month's Aircraft Section.

BURSTING AT THE SEAMS . . . Central systems are designed for many years of service, but eventually they can reach a point where they've outgrown their britches. That's what happened at Richardson Co. *Bigger Piping and valves* tells the remedy.

BLUE PENCIL AWARD . . . We got many reactions to our description of Distilled Writing which was published in March. One of the best is published in this month's Letters to the Editor columns. You too can be a super-distiller. Try your hand at it. It's fun. Take the first two paragraphs of the article on page 65 and distill 'em. Send your version to us. We'll award an editor's genuine blue pencil to readers sending in the best distillation.

Editors Keith Carlson and Allan Morris (standing) discuss this month's cover with artist Dick Zaleski. Plastic model helped in showing how new pump works.

T-J spacemaker cylinder

Quality Engineered

to give quality results

with Extras . . . at No Extra Cost!

You get more—much more—when you specify and use any of T-J's complete line of Spacemaker cylinders. The Spacemaker is engineered to give you better, more accurate, and longer service—offers, exclusively, many extras . . . that are STANDARD, AT NO EXTRA COST!

Designed to eliminate tie-rods, providing greater strength . . . saves space . . . reduces manhours and costs in all push-pull-lift operations. OFF SHELF DELIVERY in a wide range of styles and capacities, with 64,000 combinations. Write for catalog SM 56-2 with complete engineering details. The Tomkins-Johnson Co., Jackson, Mich.

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RIVITORS. AIR AND HYDRAULIC CYLINDERS. CUTTERS. CLINCHORS

METAL PISTON ROD SCRAPER . . . Standard at No Extra Cost!

NEW "SUPER" CUSHION FOR AIR . . . Standard at No Extra Cost!

CHROME PLATED CYLINDER BORES AND PISTON RODS . . . Standard at No Extra Cost!

ONE PIECE PISTON . . . Standard at No Extra Cost!

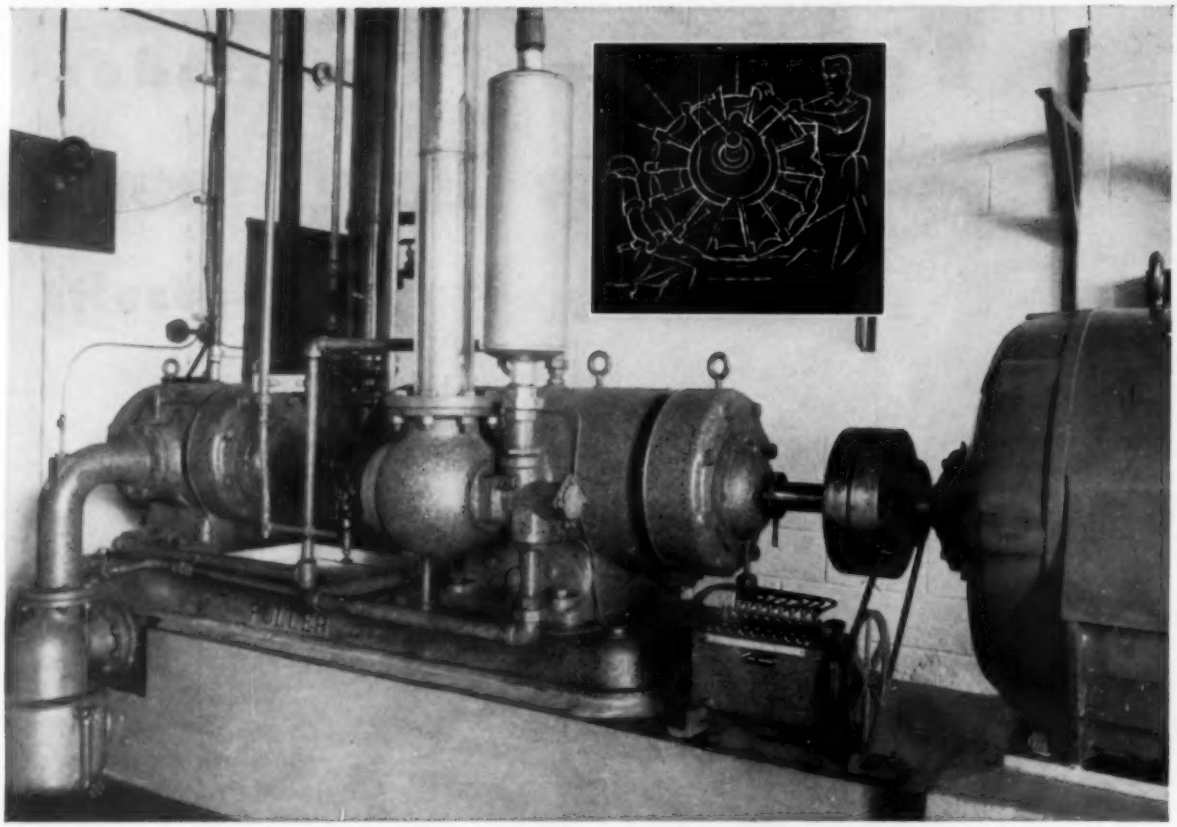
NEW "SELF-ALIGNING" MASTER CUSHION FOR HYDRAULIC USE . . . Standard at No Extra Cost!

NO TIE-RODS TO STRETCH . . . Standard at No Extra Cost!

STREAMLINED DESIGN . . . Oil Pressure to 750 P.S.I.—air to 200 P.S.I. Standard at No Extra Cost!

FORGED SOLID STEEL HEADS . . . Standard at No Extra Cost!

CIRCLE 121 ON READER SERVICE CARD



WHY DID AIRWORK SPECIFY A FULLER AIR COMPRESSOR?

Here's what the Vice President-Operations of Airwork Corporation, one of the nation's leading aircraft overhaul companies, writes about Fuller Model C-150-150H Rotary Air Compressors.

"We were running out of air capacity, and had decided that we would like to get rid of the maintenance problems inherent in a piston type air compressor.

"The Fuller compressor with its fewer moving parts and favorable price range met our basic requirements.

"We then checked on Fuller compressor performance through our close contacts with a leading manufacturer of aircraft engines. Their opinion was very favorable. We think Airwork has made the right decision."

Here are the features that sold Airwork on a Fuller Compressor:

- Wide seal between rotor and bottom of cylinder, assuring high volumetric efficiency.
- Rotary design assuring vibration-free flow of air.
- Direct drive.
- Compact space-saving installation.
- Simple foundation.
- No valves to leak or seats to grind.
- Few moving parts, keeping maintenance time to minimum.
- Designed for continuous duty service

When your plant needs reliable air power, call on Fuller. To get all the facts on Fuller Rotary Compressors for capacities up to 3300 C.F.M. and pressure to 125 pounds, write today,

Fuller

FULLER COMPANY GENERAL AMERICAN

FULLER COMPANY

C-323
4914

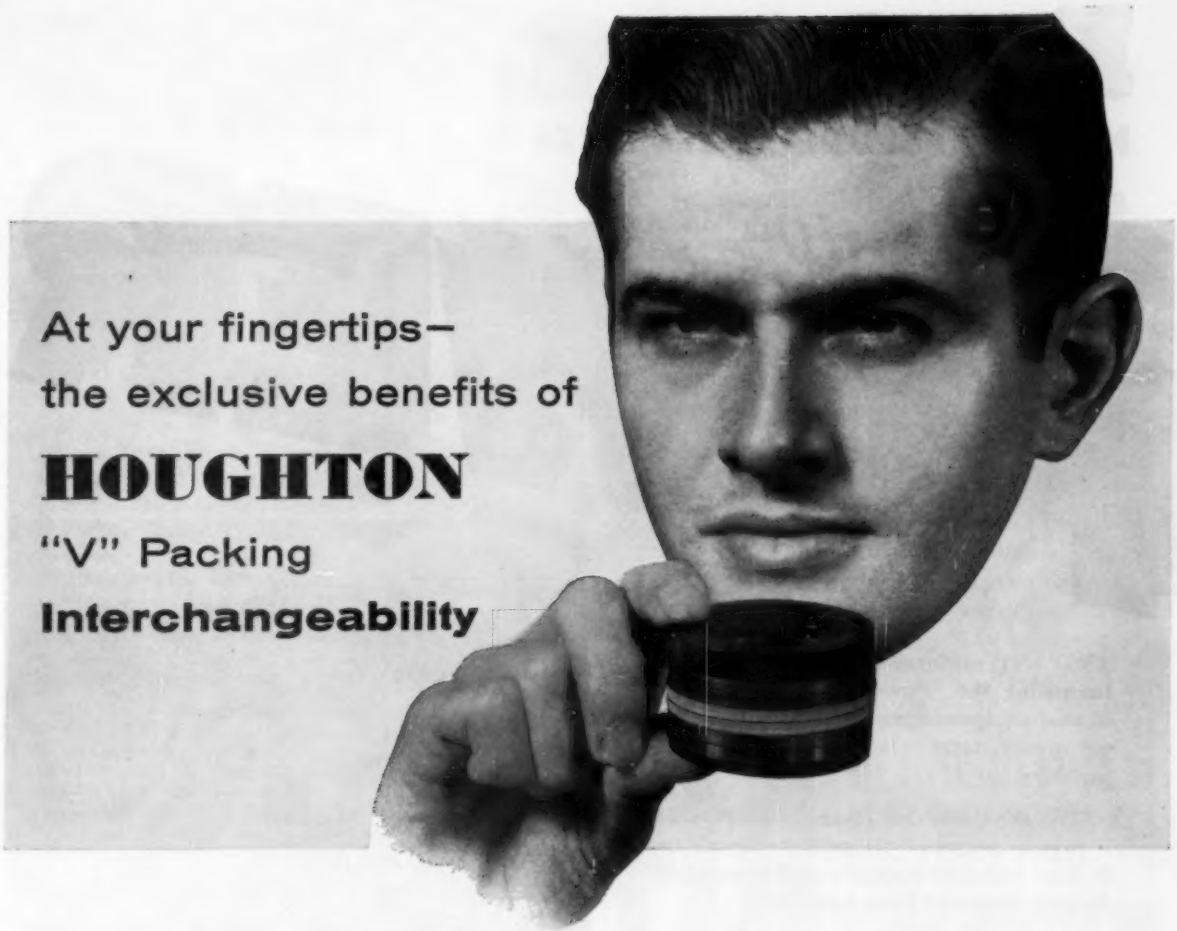
142 Bridge St., Catasauqua, Pa.

SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION

Birmingham • Chicago • Kansas City • Los Angeles • San Francisco • Seattle

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

CIRCLE 45 ON READER SERVICE CARD



COMPLETE INTERCHANGEABILITY among Houghton leather, rubber, and fabric "V" packings provides users the solution to a long-standing problem—the choice of packings for an application that demands properties no single packing material can provide.

Now, the identical stack heights of all Houghton "V's" permit *unlimited* switching of "V" combinations in any gland, either with sets of the same material, or among units of different materials within a set.

You can use a leather "V" for anti-extrusion, strength, and low friction, with a rubber unit for wiping efficiency and low cost. You can switch from rubber to a fabricated unit to gain extra strength. You can even use all three "V's" in one set, all in the same gland.

Houghton interchangeability of packings is a terrific advantage to designers who specify gland size according to J. I. C. Standard Stack Heights. New efficiency, better sealing, better performance result because you can mix packings any way you wish—get the exact kind of seal you wish.

Ask the Houghton Man . . . or write E. F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.

"V" PACKINGS . . . *products of* . . .

E. F. HOUGHTON & CO.

PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

CIRCLE 59 ON READER SERVICE CARD

Eastman

HIGH PRESSURE ASSEMBLIES

for

Responsive POWER

INSTANT response means extra POWER. Improving the "Power-Performance Ratio" of your equipment may mean an extra bucket per minute, extra tons per hour, extra loads per day.

With the increasing emphasis on POWER, it pays to safeguard the most important link in your hydraulic system with Eastman *High Pressure* Hose and Tube Assemblies.

Eastman Coupling Design gives you maximum orifice, consistent with essential safety and strength, to provide "trigger-response" through unrestricted flow from pump to point of work—plus prompt return.

BENT TUBING TO YOUR SPECIFICATIONS

Eastman's modern, hydraulically-controlled tube bending equipment provides bent tubing to your precise specifications—made with flared or beaded ends for your required fittings. Quality workmanship assures satisfactory performance. Mass production economies assure competitive quotations.

For positive power delivery and efficiency throughout your hydraulic system—plus appearance and sales appeal—it pays to specify Eastman High Pressure Hose and Tube Assemblies for your original equipment.

PERMANENTLY ATTACHED MALE (BPTF)
America's most popular OEM Coupling for 1, 2, and 3 wire braid rubber cover hose, and 4 spiral wire extra high pressure hose.
Sizes: ⅜" thru 3".
Working Pressure: 375-5000 p.s.i.
PERMANENTLY ATTACHED SWIVEL FEMALE
Eastman permanently attached couplings give you a bond stronger than the hose itself! For 1, 2 and 3 wire braid rubber cover hose.
Sizes: ⅜" thru 2".
Working Pressure: 375-5000 p.s.i.
PERMANENTLY ATTACHED FLANGE HEAD COUPLINGS
A no-thread, no-leak "O" ring connection, with split flange and insert available in angles from 0°-90°, for 1 and 2 wire braid rubber cover hose.
Sizes: ¼" thru 2".
Working Pressure: 375-5000 p.s.i.
INTER-LOCK® CLAMP COUPLINGS
Exclusive Combination: Clamp-type coupling with "Inter-Lock" feature and blowout-proof split flange for 1 and 2 wire braid rubber cover hose.
Sizes: ¼" thru 2".
Working Pressure: 375-5000 p.s.i.
2-PIECE REUSABLE SWIVEL FEMALE
Increase serviceability of your original equipment with Eastman Reusable Couplings—for rubber and cotton cover hose.
Sizes: ⅜" thru 1¼".
Working Pressure: 375-5000 p.s.i.

Eastman
first in the field

MANUFACTURING COMPANY
Dept. AH-5 • MANITOWOC, WISCONSIN

WRITE FOR HIGH PRESSURE CATALOG!
Get on our mailing list to receive out latest Technical Bulletins, Catalogs and Special Inserts.

LETTERS
to the editor

Address your letters to: Editor, APPLIED HYDRAULICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

Water Hydraulics

TO THE EDITOR:

Congratulations on your fine job of presenting water hydraulic systems in the February issue of APPLIED HYDRAULICS. Everybody is talking about the impartial way in which you presented the thinking of various equipment manufacturers.

We have been getting numerous requests for reprints of this report. Are reprints available? What would be our cost in quantities of one hundred?

R. KENNETH CROBHOLZ
Manager
Power Pump Sales
Worthington Corporation
Oil City, Pa.

Reprints of this 16-page report are still available. Single copy price is 50¢. Price per hundred copies is $25.00.

Gear Motor Needed

TO THE EDITOR:

We need a hydraulic motor, preferably gear type, which will deliver approximately 400 ft-lb of torque at 100 to 120 rpm.

R. T. MCMILLAN
Engineering Dept.
Acme Machinery Co.
Williamson, W. Va.

Names of several motor manufacturers have been forwarded to you. Hope your design allows the use of a gear reduction.

Air Filters

TO THE EDITOR:

We have our January issue of APPLIED HYDRAULICS and have noted the *Quick Guide to Product Selection* with interest. Let us congratulate you on a job well done.

We are delighted with the listing we received. We do notice

Continued on page 14

all STEEL

New Fulflo all-steel, piston type, oil relief hydraulic by-pass valves combine proven features with the advantages of all-steel construction in flange models from 1" to 3".

FULFLO

ALL-STEEL, ALL-BRASS OR OTHER COMBINATIONS FOR POSITIVE AUTOMATIC PRESSURE CONTROL YOU CAN DEPEND UPON AT ALL TIMES

all BRASS

Fulflo Valves feature shear-closing action for quiet, non-chattering operation. They offer greatest safety, matched to job conditions. Priced right for O.E.M. use . . . built right for superior replacement service.

• Standard and flanged models • Just 6 springs for pressures to 500# • Steel, cast iron or brass bodies • Brass, steel or stainless pistons • Pipe sizes to 3" • Specials to your requirements

COMPLETE CATALOG FREE ON REQUEST

THE FULFLO SPECIALTIES CO., INC.
415 Fancy Avenue, Blanchester, Ohio

FULFLO

CIRCLE 44 ON READER SERVICE CARD

Helping Hands

TO SOLVE *TOUGH* SEALING PROBLEMS

Taming the tough ones is day-in-day-out routine at Aero Gasket . . . yet our service is *specialized,* with diaphragms being *custom* molded to meet rigid specifications . . . customer, commercial, military.

We maintain a complete laboratory to insure quality control of every product from design to final delivery. We have developed special designs to meet a wide range of specific applications where long flexing life, wide temperature ranges and high operating pressures are major requirements.

Send us your specifications. We'll be pleased to provide specific recommendations that will solve your problems.

Aero Gasket produces, in a wide range of materials and assemblies . . .

GASKETS • DIAPHRAGMS • MOLDED RUBBER PARTS • METAL STAMPINGS
METAL TO RUBBER BONDING

THE
AERO GASKET
CORPORATION
770 Hanover Street, Meriden, Connecticut

LETTERS

though, the common error of adding an extra "n" to Hankison was made.

Also, under *Filters, Compressed Air,* we only showed our maximum, free air capacity size. In examining the chart, we see that we should have filled in all of the blocks up to and including 500 cfm.

We believe the guide issue is excellent, and that we can use it to good advantage ourselves.

JOHN H. BRYAN
Sales Manager
Hankison Corp.
Pittsburgh, Pa.

Super Distiller

TO THE EDITOR:

Here's suggested distillation of your card "Distilled Writing" inserted in the March issue of APPLIED HYDRAULICS.

LORANCE E. STERNS
President
Whittington Pump & Engineering Corp.
Indianapolis, Indiana

Super-distilled writing saves your time
You're busy
Everyone is
You can't read everything
Super-distilled writing
Tells ALL the facts
Clearly
Simply
Briefly
Precisely
Our trained staff of experts
Apply super-distilled writing to all copy
Results:
Shorter articles
More articles
Better writing
Easy reading
Less mental gymnastics while reading
Saves you time
You will like the super-distilled writing in this issue and subsequent issues.

Thanks Mr. Sterns. And to all readers with a similar flair: take a look at "Blue Pencil Award" on page 8.

Continued on page 16

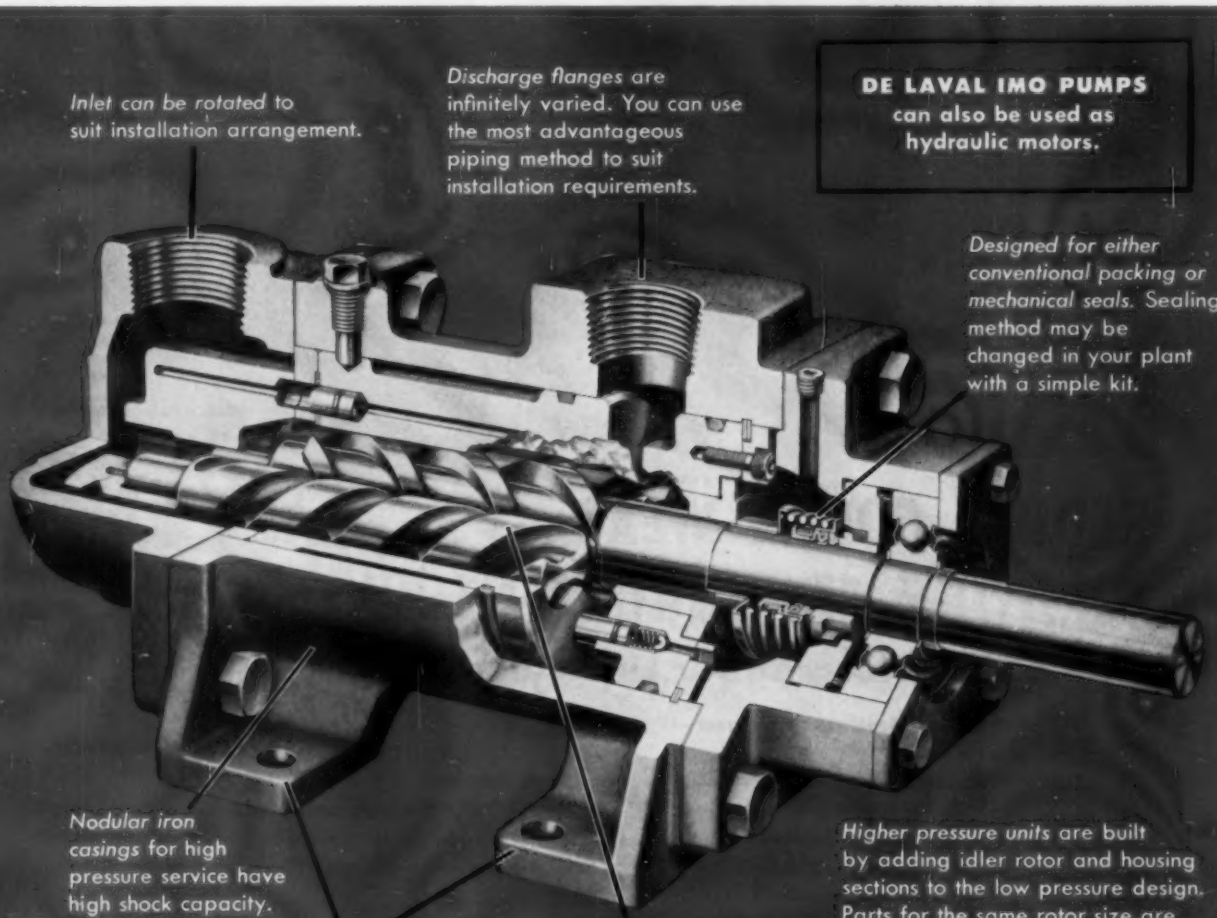
CIRCLE 4 ON READER SERVICE CARD
CIRCLE 31

DE LAVAL
IMO PUMPS

are now more versatile than ever

De Laval IMO pumps have proved that they do a dependable job over long years of service. The reason is IMO design simplicity. These constant displacement rotary pumps have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation. There are no timing gears, cams, valves, sliding vanes, or reciprocating parts to wear or become noisy. *Quiet*, compact IMO pumps are excellent for direct-connected, high-speed operation.

In addition to these basic pumping advantages, the improved IMO gives you important new benefits shown in the cutaway illustration below.


Inlet can be rotated to suit installation arrangement.
Discharge flanges are infinitely varied. You can use the most advantageous piping method to suit installation requirements.
DE LAVAL IMO PUMPS can also be used as hydraulic motors.
Designed for either conventional packing or mechanical seals. Sealing method may be changed in your plant with a simple kit.
Nodular iron casings for high pressure service have high shock capacity.
Higher pressure units are built by adding idler rotor and housing sections to the low pressure design. Parts for the same rotor size are interchangeable over the entire pressure range.
Any position mounting is possible without factory modification.
Internal parts are designed as a package so that units can be built into your machines.

Bulletin 3001 gives data on improved De Laval IMO pumps. Send for your copy today.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY

906 Nottingham Way, Trenton 2, New Jersey

12 NEW ¾" and 1" Norgren AIR LINE FILTERS

Make Norgren the most complete line available!

For ¼" through 1½" Pipe Sizes
Up to 300° F Operating Temperature
Removable Bowl
5 to 250 psi Operating Pressure
Automatic or Manual Drain
Highly Efficient Water Removal
Norgren

REDUCE COSTLY WEAR ON YOUR AIR EQUIPMENT

...with Norgren Air Line Filters

- **Now, 98 Models to choose from**—¼", ⅜", ½", ¾", 1", 1¼" and 1½".
- **Abrasive Solids and Corrosive Liquids** are removed from air lines, reducing equipment wear, repair and replacement costs.
- **Transparent or Metal Bowls**
- **Choice of 4 Filter Elements**—74, 64 or 25 micron...5 micron available in some sizes.
- **Automatic or Manual Drain**

For complete information about Norgren Air Line Filters, call your nearby Norgren Representative listed in your telephone directory—or **WRITE FOR No. 900 CATALOG**

If it's Norgren...It's Dependable.

C. A. NORGREN CO.

3402 SO. ELATI STREET • ENGLEWOOD, COLORADO

LETTERS

Electrical Controls

TO THE EDITOR:

I find your series of articles, Electrical Components for Fluid Powered Equipment published during 1956 and 1957 of considerable value. Is a copy of the complete series available?

A. G. BIKOVSKY
Design Engineer
The Bullard Company
Bridgeport, Conn.

Sorry, the complete series was not reprinted. You can order photostats of the series of six articles for $3.00.

Reversing Pump

TO THE EDITOR:

Is there a method to continuously reciprocate a hydraulic cylinder without the use of external valves?

G. T. WALSH
Western Research and Engineering Co.
Chicago, Ill.

It is of course possible to build a package in which valves are integral with the cylinder. Perhaps a more practical solution for your purpose is the use of a reversing pump which controls direction of the hydraulic cylinder in a closed circuit. Names of several manufacturers who can help you have been sent.

To receive a copy of
THE FLUID POWER PRIZE PAPER RULES BOOKLET
Circle 240 on Reader Service Card

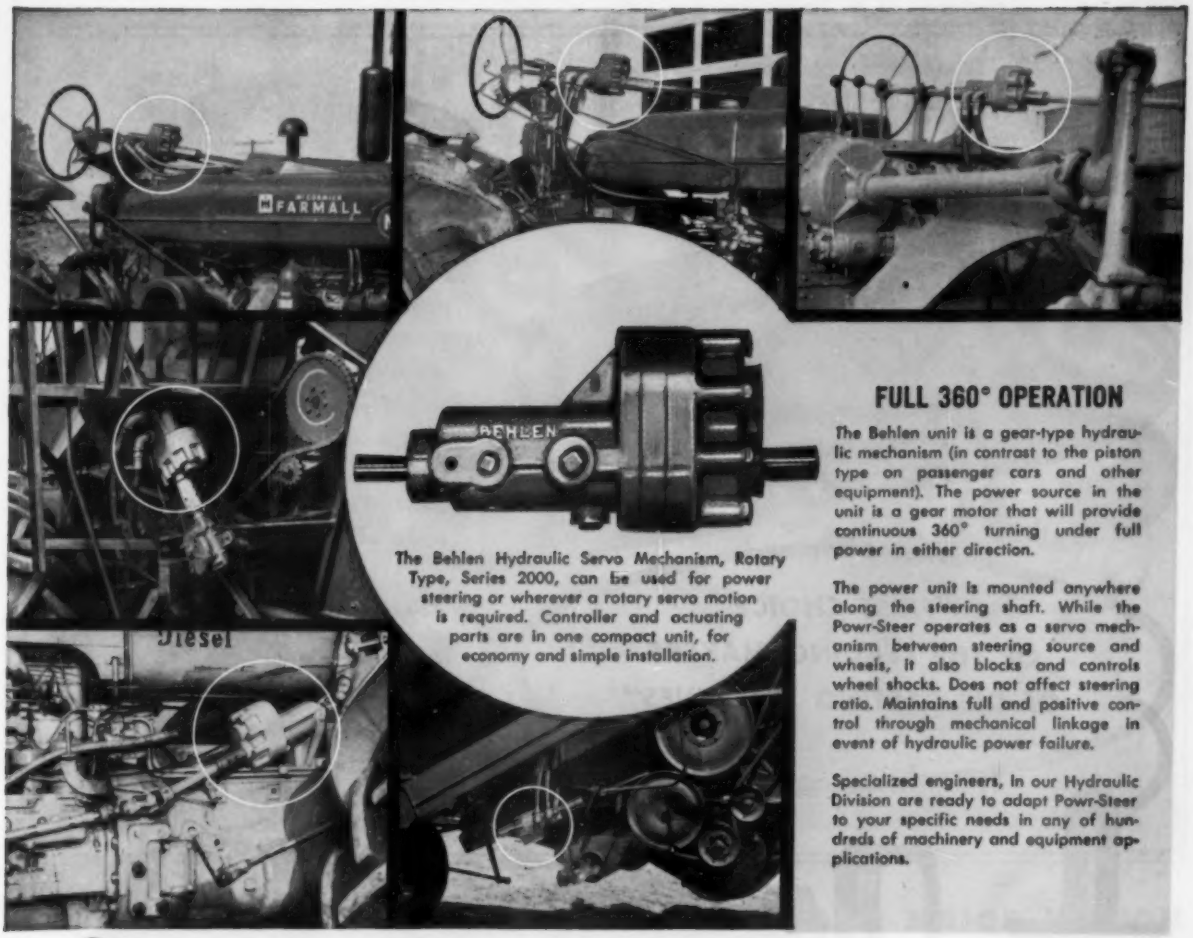
Data Section

TO THE EDITOR:

We have a copy of your FLUID POWER DIRECTORY in our reference library. Is section "D", Fluid Power Design, available as a separate book?

C. C. PALLISER
West & Du Toit (Pty.) Ltd.
Johannesburg, South Africa

Copies of the entire Directory sell for $6.50 *each* ($7.50 *for foreign orders). Section D is not available separately.* ▼▼▼



The Behlen Hydraulic Servo Mechanism, Rotary Type, Series 2000, can be used for power steering or wherever a rotary servo motion is required. Controller and actuating parts are in one compact unit, for economy and simple installation.

FULL 360° OPERATION

The Behlen unit is a gear-type hydraulic mechanism (in contrast to the piston type on passenger cars and other equipment). The power source in the unit is a gear motor that will provide continuous 360° turning under full power in either direction.

The power unit is mounted anywhere along the steering shaft. While the Powr-Steer operates as a servo mechanism between steering source and wheels, it also blocks and controls wheel shocks. Does not affect steering ratio. Maintains full and positive control through mechanical linkage in event of hydraulic power failure.

Specialized engineers, in our Hydraulic Division are ready to adapt Powr-Steer to your specific needs in any of hundreds of machinery and equipment applications.

Increased production catching up with demand:

Behlen HYDRAULIC SERVO MECHANISM

Rotary Gear-Type Power Steering

This Behlen unit is now available for more original equipment manufacturers of:

Farm tractors	**Motor graders**
Combines	**Motorized Cranes**
Fork-lift trucks	**Tractor shovels**

. . . and all similar industrial, heavy construction and agricultural equipment applications . . . wherever a perfected rotary servo-motion power assist can reduce the need for muscle-power and manpower.

The Behlen Hydraulic Servo Mechanism was introduced six years ago as a field-installed power steering unit for row crop tractors. Soon thousands of farmers were enjoying the ease and safety of Behlen Powr-Steer, applied to tractors of nearly every make and model. International Harvester adopted it as original equipment on their Farmalls 300 and 400 series. Other manufacturers of self-propelled equipment quickly followed — at a pace that outstripped our production capacity.

Recently we completed a big plant expansion program. Now we're ready to supply the Behlen Hydraulic Servo Mechanism on a scale and schedule to meet your needs.

We want you to see how easily the mechanism can be applied to your products as original equipment, and how it can add a big plus to the sales appeal. Get in touch with us now.

Phone, write or wire Howard Christenson, production manager

BEHLEN MANUFACTURING COMPANY • Dept. AH-5 • Columbus, Nebraska

World's largest manufacturer of tractor and grader power steering

Vogt

DROP FORGED STEEL VALVES and FITTINGS

Modern die casting machine operation involves the use of standard hydraulic oils as well as special non-inflammable oils which must be safely and positively controlled at pressures from 800 pounds up to 4000 pounds per square inch.

Vogt drop forged steel valves, fittings, flanges and unions are unsurpassed for these rigorous duties and are standard equipment on the leading makes of die casting machines.

Consult Catalog F-9 for the complete line of Drop Forged Steel Valves, Fittings and Flanges.

"FIRST CHOICE OF THE LEADING MAKERS OF DIE CASTING MACHINES"

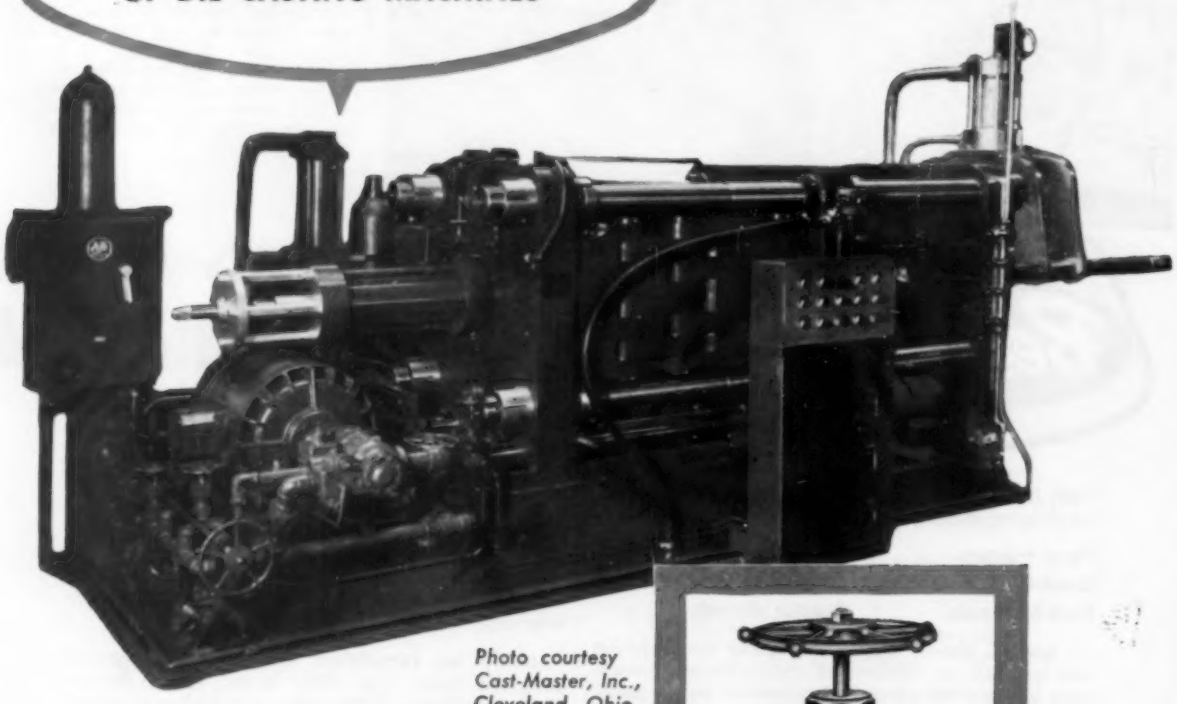


Photo courtesy Cast-Master, Inc., Cleveland, Ohio

HENRY VOGT MACHINE CO.
P.O. Box 1918
Louisville 1, Kentucky

SALES OFFICES:
New York, Chicago, Cleveland, Dallas, Philadelphia
St. Louis, Charleston, W. Va., Cincinnati

OTHER VOGT PRODUCTS
Drop Forged Steel Valves, Fittings and Flanges in a complete range of sizes • Petroleum Refinery and Chemical Plant Equipment • Steam Generators • Heat Exchangers • Ice Making & Refrigerating Equipment

SERVICE AVAILABILITY IS ANOTHER MAJOR REASON WHY OEM DESIGNERS SPECIFY BELLOWS AIR MOTORS

In your products, as in ours, service to customers is an important selling tool. When you specify Bellows Air Motors and other Bellows pneumatic devices and controls as components in your machines—you know, wherever the machine will be shipped, there will be a Bellows Field Engineer nearby.

Over 150 full time, fully trained Bellows Field Engineers, in every important industrial area in the United States and Canada, in Great Britain, in Europe, and Australia are available to give quick, efficient and friendly help if it's needed. And seven manufacturing and assembly plants in the States, in Canada, in Great Britain and Europe safeguard your customers from "down time" due to "parts" delays.

Add to "service availability" the design and cost advantages this unique air cylinder with the built-in valve offers you: compactness, speed, precision-control and low cost—and it's easy to see why the Bellows Air Motor ranks first with design engineers.

This booklet tells the story "The Place of the Bellows Air Motor in Original Equipment Design" tells in 14 quick-reading pages how the Bellows Air Motor can fit into your program. Free on request. Address Dept. AH-558, The Bellows Co., Akron 9, Ohio.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

1029-B

design, planning and maintenance men . .

$15,000.00 "WIN WITH

1st PRIZE $1,500.00

Next 8 Winners . . E

. . . and 175 Other Cash Prizes

Perhaps no other fitting has contributed more to advancements in the field of hydraulics or has attained wider recognition and usage in critical applications than has the famous Weatherhead Ermeto flareless tube fitting. Not only is the Ermeto fitting known for its greater dependability where high pressures, excessive temperatures, surge and vibration are vital factors; it is also popular for its simple, low-cost installation and maintenance advantages as compared to other types of high pressure fittings.

The Weatherhead Company has on file many case histories authenticating the unequalled performance of Ermeto fittings. Without question there are many other types of applications on which we do not have full technical data. With this contest as an incentive and with your cooperation, we hope to be able to compile and make available to engineers and users everywhere a broad range of valuable application data which should offer solutions to some of your most troublesome engineering problems. Weatherhead's most important obligation is the development of ways and means for the advancement of the fluid power industry.

CONTESTANTS PLEASE NOTE!

For additional reprints of this ad or for further contest information, contact your local Weatherhead distributor or write Win With Ermeto Contest, P. O. Box 2457, Fort Wayne, Indiana.

WEATHERHEAD

THE WEATHERHEAD CO., FORT WAYNE DIVISION
Dept. A-5, 128 West Washington Blvd., Fort Wayne, Indiana
In Canada: The Weatherhead Co., Ltd., St. Thomas, Ontario

. . you can win yourselves a hunk of dough in this . . .

WEATHERHEAD ERMETO" CONTEST

2nd PRIZE $1,000.00

. Each Will Get $750.00

CONTEST RULES

1. This contest is open to everyone actively associated with the design and/or maintenance and operation of equipment in any type or field of industry or commerce including independent design or service engineers. Not eligible are personnel of the Weatherhead Company, its distribution outlets or its advertising agency.

2. At top of first page of each entry must appear contestant's name, home address and phone number; company name, address, phone number.

3. In preparing your entry use **only one side** of sheet or sheets.

4. Contestant may enter as many different types of Ermeto applications as he wishes but each must be a separate finished manuscript in itself.

5. Contest ends September 30, 1958 and entries must be postmarked no later than midnight of that date. Winners will be announced as soon thereafter as judging can be completed. In case of a tie, duplicate awards will be made.

6. Judging the contest will be qualified graduate engineers of high standing and not associated with Weatherhead Company or its sales outlets. Their decisions will be final.

7. All entries must be based on actual installations backed by factual data which can be fully verified.

8. All entries become the property of the Weatherhead Company.

AWARDS

1st Prize		$ 1,500.00
2nd Prize		1,000.00
Next 8 Winners	$750.00 each	6,000.00
Next 35 Winners	100.00 each	3,500.00
Next 40 Winners	50.00 each	2,000.00
Next 100 Winners	10.00 each	1,000.00
Total Winners 185	Total Cash Awards	$15,000.00

TO HELP YOU PREPARE A WINNING ENTRY

1. Your entry will be judged on the basis of how fully it covers all the facts relative to the installation you are describing. It should point up how or why Weatherhead flareless Ermeto tube fittings helped master a problem or achieve greater economy.

2. Drawings of the installation and pictures should accompany your manuscript if at all possible.

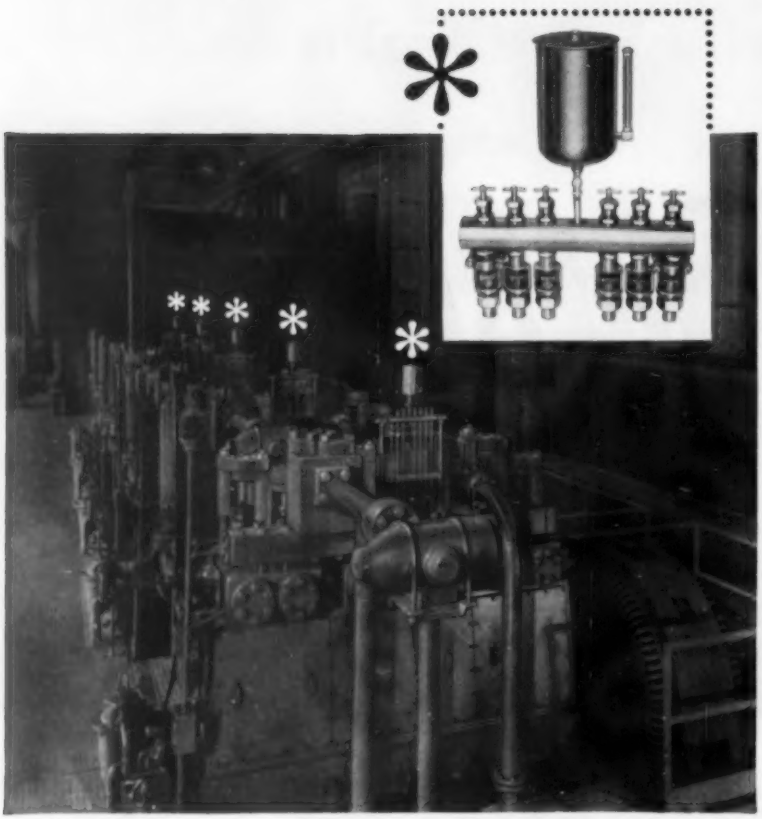
3. Unusual applications, excessive pressures or heat conditions, problems of surge or vibration, all are important data for your manuscript.

4. The following is offered as a guide to you in completing your manuscript . . . Type of equipment and its end product or function • Specific supporting function of the Ermeto equipped circuit • Location of equipment • Climatic conditions of equipment area • Restricting factors surrounding equipment • Downtime and maintenance factors • Style and material of Ermeto fittings and number in circuit • Material of connecting tubings • Working pressures • Maximum shock or impulse load • Maximum and minimum working temperatures of circuit • Vibration-maximum deflection factors • Type of hydraulic fluid used • Thickness of tube walls • To what piping specifications does circuit conform • Service life of Ermeto fittings being used • Savings or other economy factors resulting from use of Ermeto fittings.

Mail Entries to:
WIN WITH ERMETO CONTEST
P. O. Box 2457, Fort Wayne, Indiana

FIRST IN HYDRAULIC COMPONENTS

CIRCLE 138 ON READER SERVICE CARD



NUGENT
MULTIPLE GRAVITY OILERS Provide Controlled Lubrication for hard-to-reach bearings

The five Worthington Power Pumps shown above supply hydraulic power for a central hydraulic accumulator system in a large aluminum mill.

Each pump is equipped with a Nugent Multiple Gravity Oiler. The feeds may be individually controlled to deliver lubrication in predetermined quantities to otherwise inaccessible bearings.

Nugent Multiple Gravity Oilers are available with 2 to 23 feeds. Pressure Sight Flow Lubricators are also part of a full line of Nugent lubricating specialties. Before you decide on any filtration or lubrication equipment . . . see what Nugent has to offer.

ESTABLISHED 1897

WM. W. NUGENT & CO., INC.
3432 CLEVELAND STREET, SKOKIE, ILLINOIS

REPRESENTATIVES IN PRINCIPAL CITIES

OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

FUTURE EVENTS

May 14-15: First European Fluid Power Conference, St. Ermins Hotel, London S. W. 1, England. For complete details write to Compressed Air and Hydraulics, Temple Chambers, Temple Ave., London E. C. 4, England.

June 2-4: National Fluid Power Association Annual Spring Meeting, Bedford Springs Hotel, Bedford, Pa.

June 9-12: American Society of Mechanical Engineers national conference on materials handling. Public Auditorium, Cleveland, Ohio.

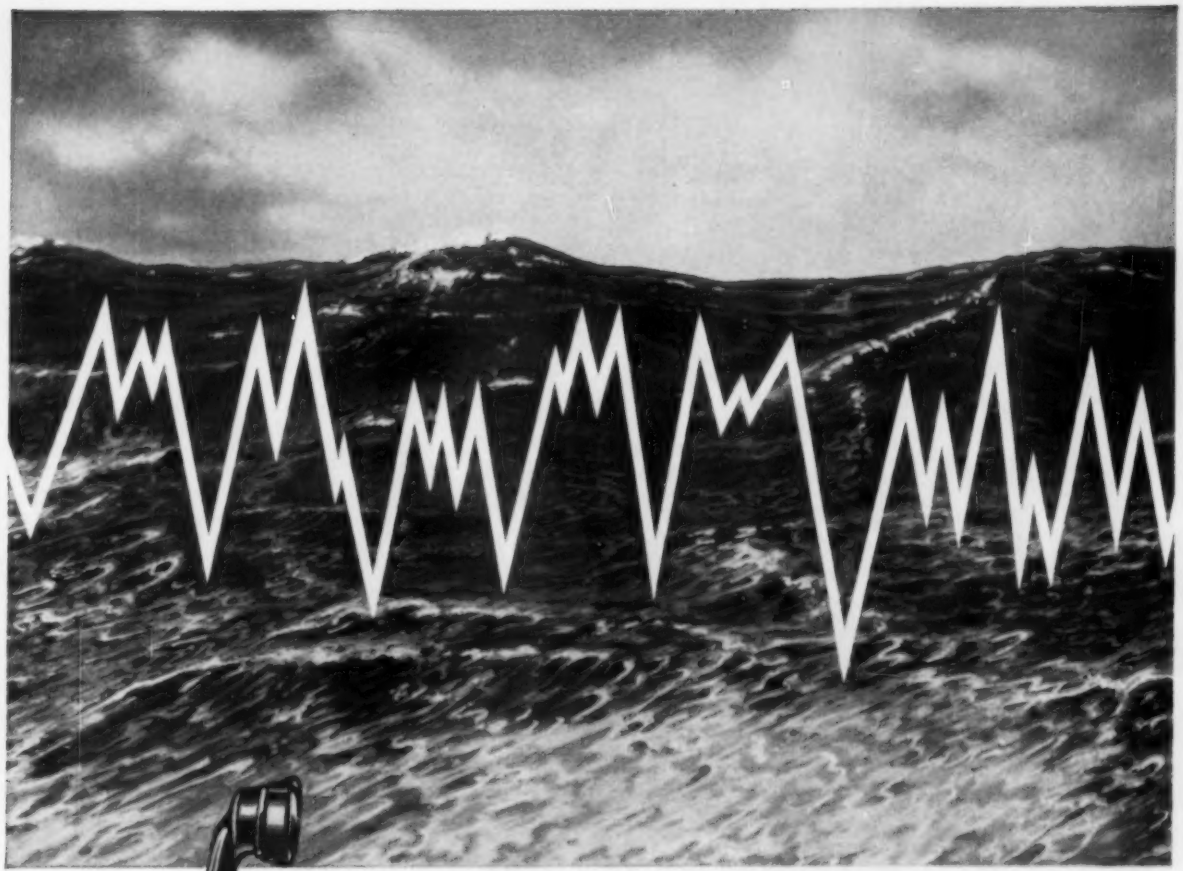
June 9-13: Fourth Annual Automation Seminar at The Pennsylvania State University. Theme, "Cost Reduction Through Automation". Contact Chester Linsky, in charge of automation at the University, for further information.

June 9-20: NCIH course in Oil Hydraulics at Illinois Institute of Technology. For information write: Dr. F. D. Carvin, M.E. Dept., Illinois Tech, 3300 S. Federal St., Chicago 16, Ill.

July 8-18: Course titled Fluid Power Control at Massachusetts Institute of Technology. For information write: Dr. J. L. Shearer, M.I.T. Cambridge 39, Mass.

September 29-October 3: ASTE Semi-Annual Meeting and Western Tool Show. Shrine Exposition Hall, Los Angeles, Calif.

October 16-17: NCIH 14th Annual Meeting. Sherman Hotel, Chicago, Ill. For complete information write Raymond D. Meade, Conference Secretary, Illinois Institute of Technology, Chicago, Ill. ▼▼▼



Telecommunications

Two recent major steps in the improvement of world telecommunications have been the laying of the first Trans-Atlantic and the California—Hawaii submarine telephone cables.

When laying cable either on a flat sea bed or over underwater mountain ranges, the exact control of paying out speed and tension in the cable is of paramount importance. On the cableship *Ocean Layer* (Submarine Cables Ltd.), the cable-laying equipment for which was supplied by Johnson & Phillips Ltd., 'VSG' variable delivery oil hydraulic pumps are used to act as brakes on the cable, which is drawn out of the ship by its own weight. This enables a very smooth and regulated control to be maintained or instantly varied to suit ship speed, paying out speed and tension in the cable.

It is just another of the highly varied applications of 'VSG' variable delivery pumps and transmission gears which have now been serving modern industry for fifty years.

'VSG'

Regd Trade Mark

SERVING MODERN INDUSTRY 1908-1958

VICKERS ARMSTRONGS (ENGINEERS) LTD VICKERS HOUSE BROADWAY LONDON SWI

Tubexperience in action

How does carbon content control hydraulic tubing quality?

Precise metallurgical controls help Superior's (SAE) Hydraulic Tubing outperform all other types

*Extra quality is the reason for the high ductility and longer, more reliable service you get with Superior hydraulic tubing. This extra quality is actually built in through precise metallurgical control.

Carbon content is held to .12% maximum through controlled atmosphere annealing. This assures highest ductility commensurate with the strength needed in the tubing.

Superior (SAE) Hydraulic Tubing is made from selected billets of non-aging steel. These are segregated by heat numbers, and a customer's order is always filled from one heat. This assures complete uniformity of all the tubing shipped to him in that order.

Each order also undergoes many critical examinations. Among these are checks on elongation, yield and ultimate strength. Every length is also 100% hydrostatically tested to maximum working pressure. And close control is exercised over grain size and microstructure. This is done microscopically with the aid of metallographic mounts. And finally, if requested, we furnish a notarized report on the chemical and physical properties of the tubing produced.

Superior (SAE) Hydraulic Tubing is furnished in dead-soft annealed temper for easy bending and flaring. Order in cut, multiple or random straight lengths up to 30 ft.—or longer in coiled form.

For more data on our (SAE) hydraulic tubing, get a free copy of Bulletin 39. Write Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

Superior Tube

The big name in small tubing

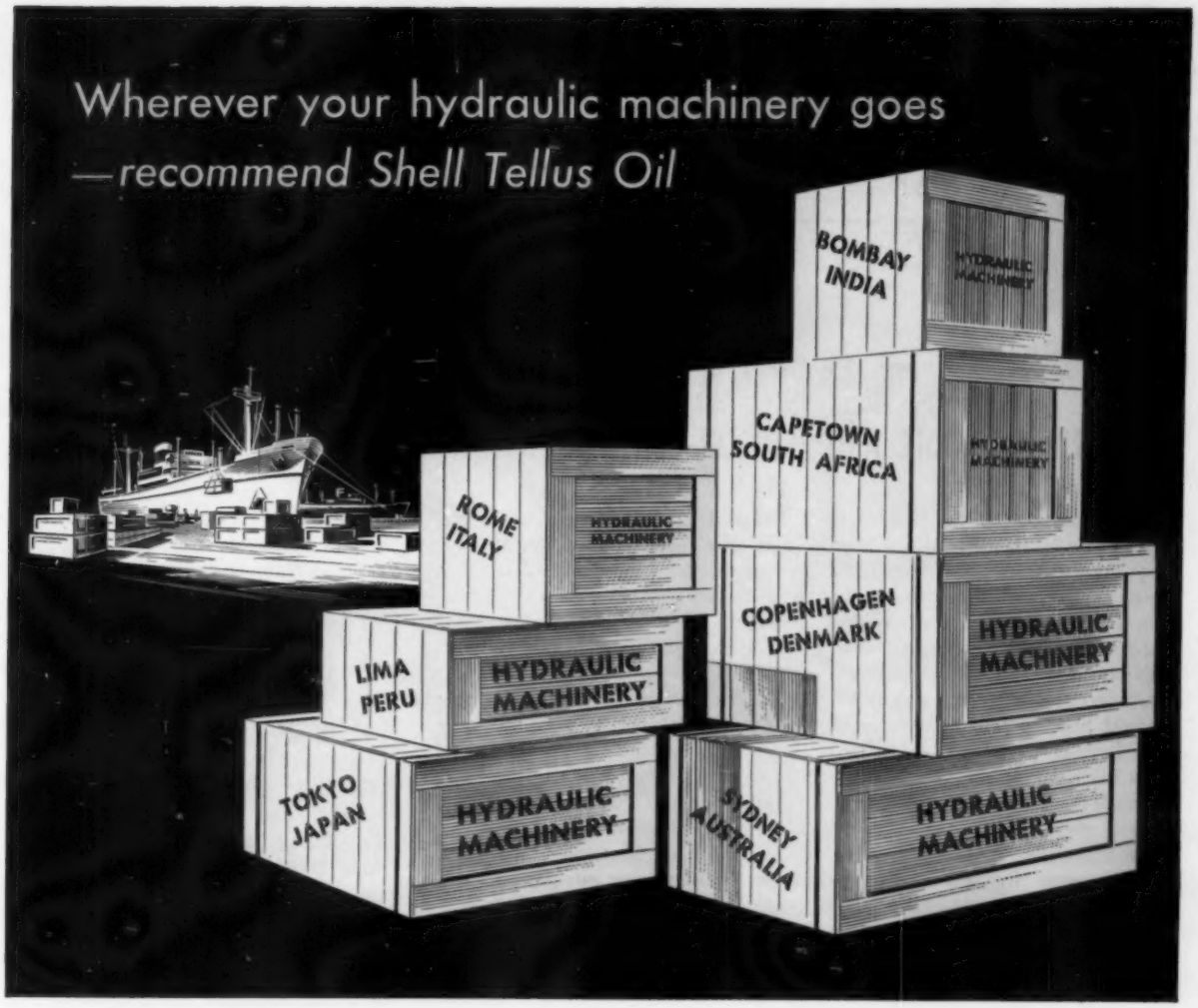
NORRISTOWN, PA.

All analyses .010 in. to ⅝ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Company • 5710 Smithway St., Los Angeles 22, Calif. • RAymond 3-1331

CIRCLE 117 ON READER SERVICE CARD

Wherever your hydraulic machinery goes
—recommend *Shell Tellus Oil*



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Shell Tellus Oil is top-rated as both a lubricant and a control fluid for complex hydraulic systems. Its ability to combat oxidation, rust, sludge-formation, wear and foaming has earned it nationwide popularity.

You may be glad to know that the hydraulic-operated equipment you manufacture can now obtain the same efficient protection in other countries of the world. Tellus* Oil is available to your customers abroad. With it they can enjoy the same performance that your domestic customers rely upon.

For more complete information on Tellus Oil, write Shell Oil Company, 50 West 50th Street, New York 20, New York, or 100 Bush Street, San Francisco 6, California.

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BRIEFS

about fluid power

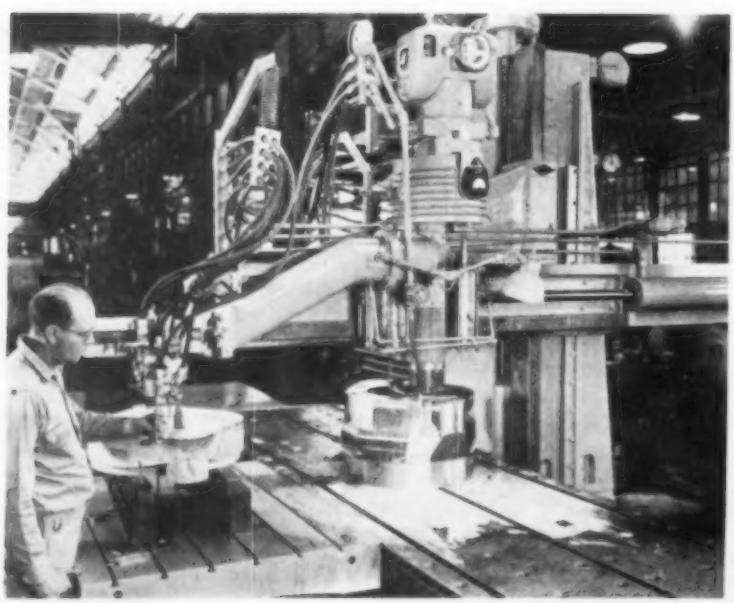
OIL DRIVES SPINDLE AND FEED ON CONTOURING MACHINE

This machine at the Torrance, California, plant of National Supply Company was converted from a planer. The machine uses a 3-dimensional hydraulic feed system and a variable-speed hydraulic spindle drive.

• **Conversion**—Engineers of National Supply, a manufacturer of oil industry equipment, designed the machine which was built by the plant maintenance department. First step was to modify the planer, so that all machine movements were hydraulically operated. A tee-slotted plate was then made to serve as a template or master-form mounting base. This is attached to the outboard side of the table and may be positioned at any point along its 16-foot length. A 3-dimensional tracer valve was mounted on a cross-rail extension. Part of the conversion was the use of a hydraulic milling spindle.

• **Hydraulic milling spindle**—In this installation a 25-hp variable speed spindle replaced the planer tool-mount. Using two, geared speed ranges, the spindle provides constant horsepower at speeds from 60 to 3000 rpm.

• **Fluid power supply**—Power for both machine movements and spindle rotation is from a 30-hp combination hydraulic power unit including a 20-gpm, variable-delivery pump for the spindle, and a dual pump of 11-gpm capacity for table traverse and 3-dimensional feed movements. ▼▼▼



Fluid Power Courses

The NCIH is again offering a two week summer course in oil hydraulics at Illinois Institute of Technology from June 9th to June 20th. There will be a full-time day program running 6 hours a day for the two weeks. The course is designed for shop, maintenance, and sales personnel, and emphasis will be placed on fundamentals with a minimum use of mathematics. The oil-hydraulics laboratory will be used for demonstration whenever possible. For more information write: Dr. F. D. Carvin, M. E. Dept. Illinois Tech, 3300 S. Federal St., Chicago 16, Ill.

Another course titled *Fluid Power Control* is being offered by the Massachusetts Institute of Technology from July 8th to July 18th. This course is intended to summarize the most important concepts of fluid power control and will deal with recent developments and current problems in the research and development work on hydraulic and pneumatic control systems. For more information write: Dr. J. L. Shearer, M.I.T. Cambridge 39, Mass. ▼▼▼

Continued on page 28

Sirvene impeller blades bend 90° at 1750 r.p.m.

– but never break, never take a "set"

Hypro Engineering, manufacturer of pumps for farm, home and industrial use, needed a better transfer pump impeller. When they came to C/R Sirvene they asked, "Can *you* compound and mold an impeller that will tolerate extreme blade deflection 1750 times a minute and resist 'setting' during long inoperative periods, and still meet our standards for service life?" Compounding to achieve resistance up to 160°F. over a wide range of mild acids, brines, detergents, oils and liquid fertilizers was relatively simple. The real problem was molding. Sirvene engineers knew that conventional methods would not assure the required flex strength. They also knew the molding technique that *would*—and went to work. Test runs on this Sirvene impeller proved out the technique and the part was approved for production. "That was five years ago," states Mr. Cook, President of Hypro Engineering, "and we haven't had an impeller problem since. When you need a flexible molded part, call in C/R Sirvene engineers. Their experience and facilities are unmatched."

Write for your copy of the new booklet, Sirvene.

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BRIEFS

Pump Speed Varies on Truck Lift

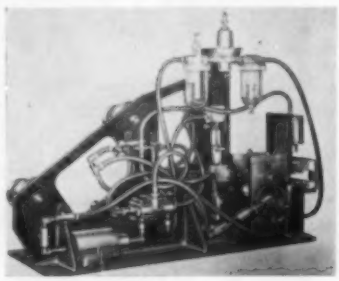
A new tail lift platform has been developed by Burtonwood Engineering Ltd. for loading and unloading trucks. The standard model enables a man to handle loads of ½ to 2 tons. The hydraulic system of this loader has a novel feature for single-hand operation, so that the idling speed of the engine and power take-off is varied in direct proportion to the load on the lifting platform.

LOADING PLATFORM on this double deck truck is operated by cylinder installed horizontally at rear of truck chassis. Engine throttle control slows engine and pump during descent.

• **Power saving**—When a load is raised, the engine speed, and pump output are increased for a fast lift. When lowering the load, the pressure in the supply line drops. This closes the engine throttle and reduces the pump speed. The weight on the tailboard is sufficient to lower it quickly, so that a power savings is gained by reducing pump delivery. This speed variation is achieved by a throttle-opening valve piped to a small plunger which actuates the throttle mechanism of the engine to adjust its idling speed. ▼▼▼

Air Powers Packaging Sealing Machine

Small foil packages are filled, stamped out, and heat sealed on this completely air powered machine. First station receives two strips of foil from coils where they are loaded and stamped out. The packages indexed to the second station are heat sealed and cut off. The cycle is controlled by a speed control valve which regulates the air to a cylinder. The



piston rod of this cylinder trips limit valves on the main control valve for the stamp cylinder, which in turn trips two cam operated valves at the top and bottom of its stroke. J. B. Morrison Machinery Co., Ltd., Toronto, Canada built this unit. ▼▼▼

To receive a copy of
THE FLUID POWER PRIZE PAPER
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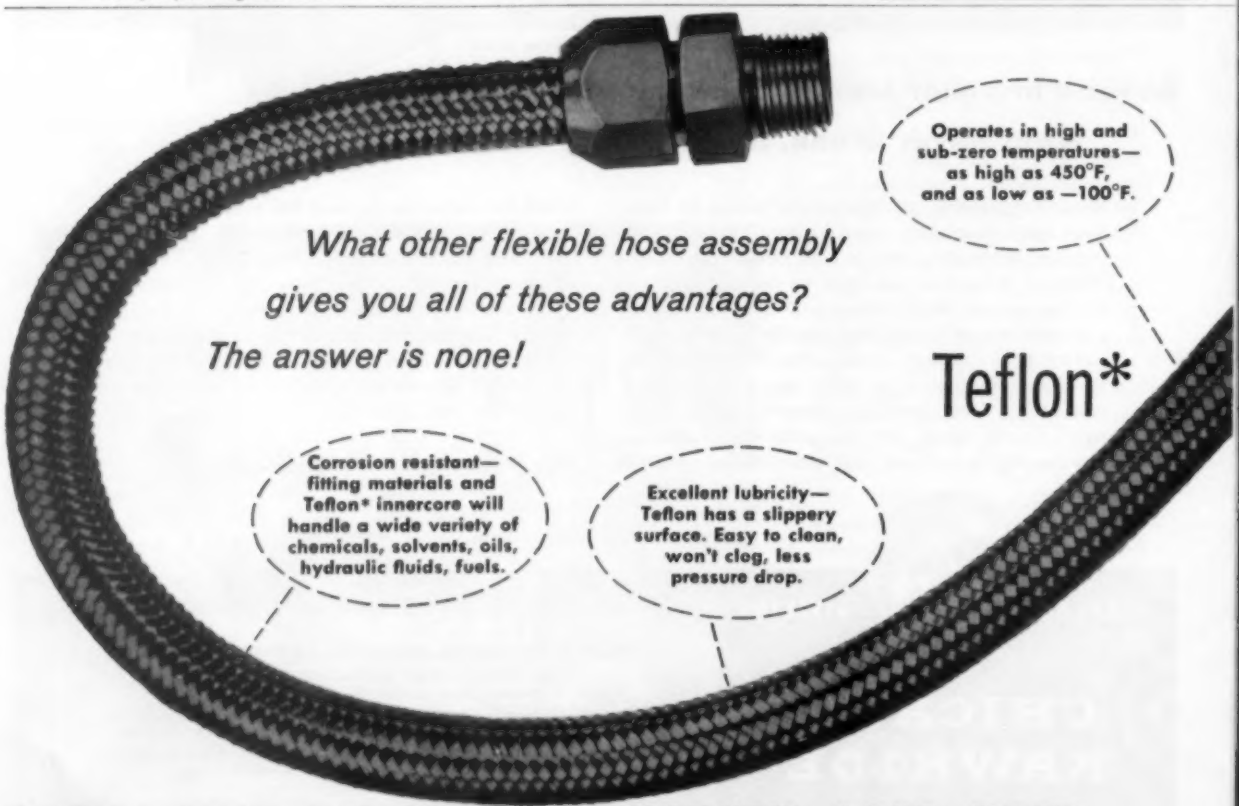
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Excellent lubricity—Teflon has a slippery surface. Easy to clean, won't clog, less pressure drop.
FROM END TO END . . . INSIDE AND OUT

Fluid Power On Trial

For its annual one-day conference, Cleveland Engineering Society's Machine Design Division held court to examine machine controls—mechanical, electrical, pneumatic, and hydraulic. Presented as a legal trial, the conference called leading system designers to state their grievances with present controls and how they can be improved. For the defense, four representatives of control manufacturers explained present capabilities of their products and their plans to meet future requirements.

Speaking for the prosecution, William Schwed, Plant Engineer of GMC's Fisher Body Div. criticized the over-control which is supplied on many machines. Controls for controls has made a complexity that is impossible for the maintenance journeyman to understand. "We want good controls, designed by good engineers, but not *for* engineers," he said.

Plant manager, Seymour

Continued on page 32

BRIEF NOTES

GUARANTEED FOREVER . . . against breakage is the promise given by Airoyal Mfg. Co. to their cylinder customers. The guarantee states that should any Airoyal cylinder or part of cylinder break it will be repaired or replaced free of charge, F.O.B. their factory, regardless of age of the cylinder or cause of the breakage.

RECORD SHIPMENT . . . of Pydraul was made when Monsanto Chemical Co. shipped a 10,000-gal tank-car of the fire-resistant hydraulic fluid. This is an indication of the acceptance of fire resistant fluids, which were introduced about 10 years ago. Gross sales of these fluids has tripled in the past 3 years.

VENDING MACHINES PROVIDE SCHOLARSHIPS . . . at the Flick-Reedy Corporation. All profits from the company's vending machines go to the employees' benefit fund. A share of the profits is set aside for scholarships. To date $1100 has been placed in the fund.

BUSINESS BRIEFS

NET INCOME UP . . . for the quarter ending Dec. 31, 1957 was reported by Eastern Industries Inc., Hamden, Conn. Net income for the period increased to $304,475 from $242,433 for the same period a year earlier. Total sales for the two periods were $3,048,000 and $2,954,000 respectively.

PARKER-HANNIFIN CORPORATION'S . . . new orders increased in February for the third successive month. S. B. Taylor, P-H's president, said the low point was in November when new orders were $2,033,000. January new orders were $2,331,000 and $3,344,000 in February.

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"140"
The Teflon innercore makes Springfield "140" hose assemblies extremely flexible. Long fatigue life.

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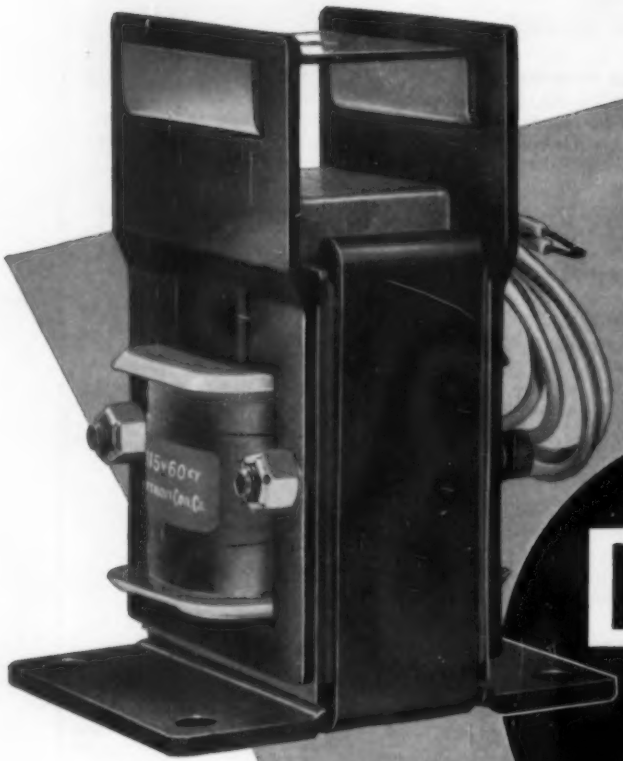

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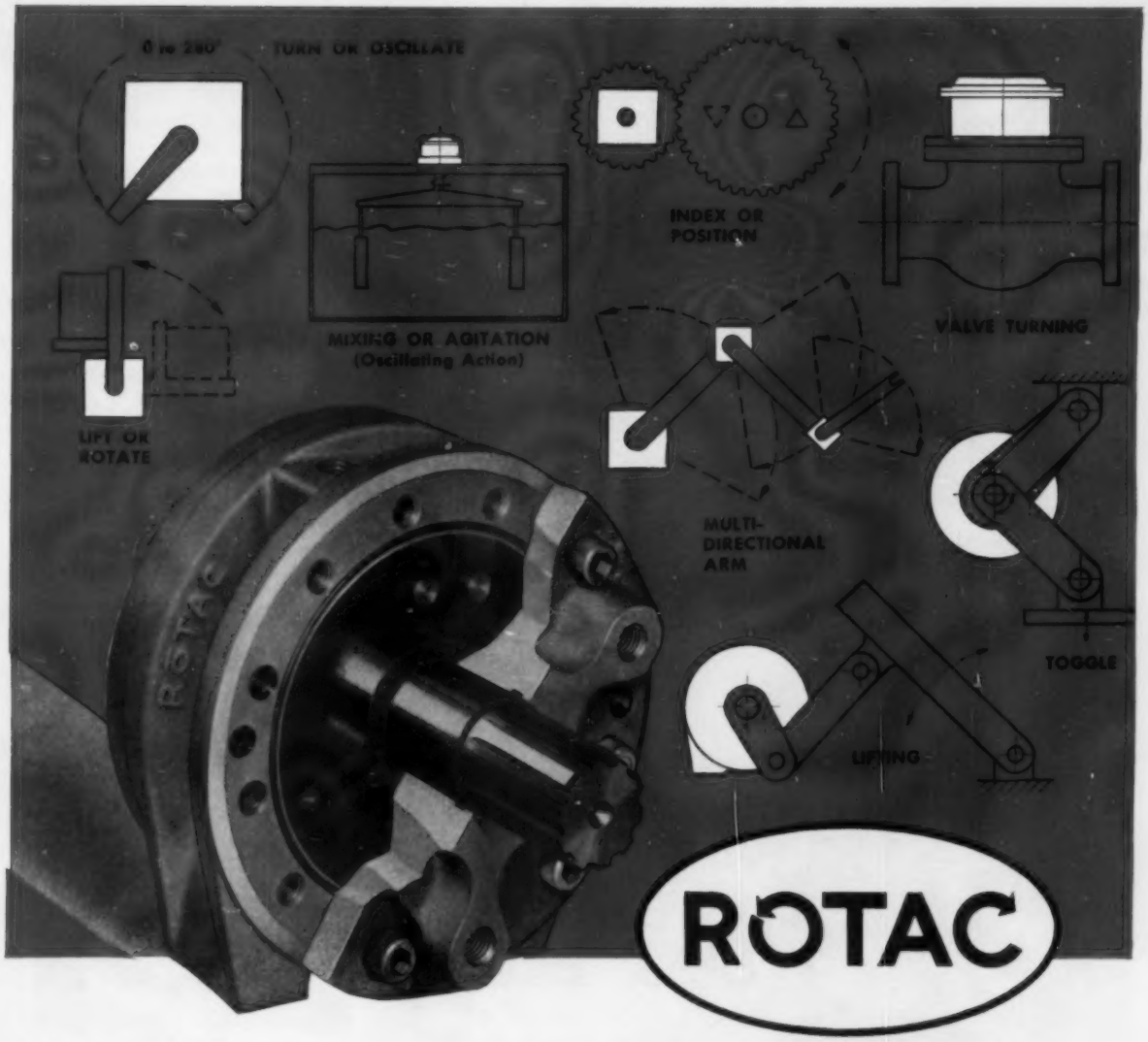

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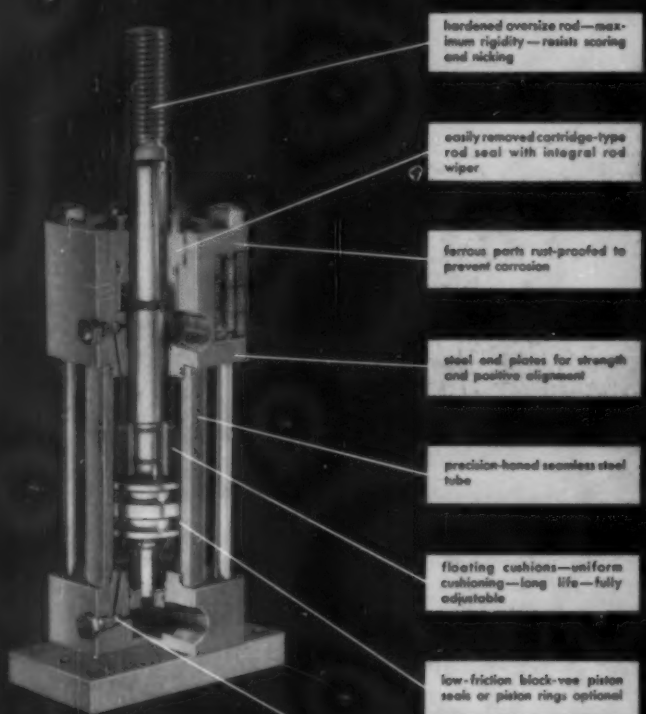
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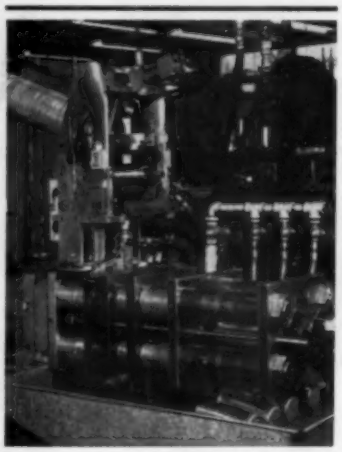
AA-7486

BRIEFS

Schlein also criticized the complexity of many machine control systems. New machines may eliminate operators, but increase the need for maintenance technicians. Versatility should be an object of control manufacturers. Too often their products are made for OEM instead of for in-plant production machines, which must often be designed using the equipment in stock.

• **Pneumatic Controls**—Air controls were "defended" by Ross Valve's Chief Engineer, Andrew Huntington. Air is easily stored, quickly used, non-flammable, and needs no return, he said. The long service life of pneumatic components is illustrated by his remarks that the 3 to 10 million valve cycles considered acceptable a few years ago is now at 15 to 50 million cycles.



FOOD packaging gets a big assist from hydraulics on this aluminum can making machine. Kraft Foods' order for 5½ million cans opens a new market for aluminum. This press developed by Kaiser forms the can bodies by drawing aluminum discs in a single stroke of the punch.

• **Hydraulic Controls**—Stating the case for hydraulic controls, Chief Engineer, Robert Erskine of Vickers, Inc. discussed components which are available now and those in development. The gasket-mounted pump, he said, is becoming more popular, especially

Continued on page 34

MINNESOTA MR RUBBER

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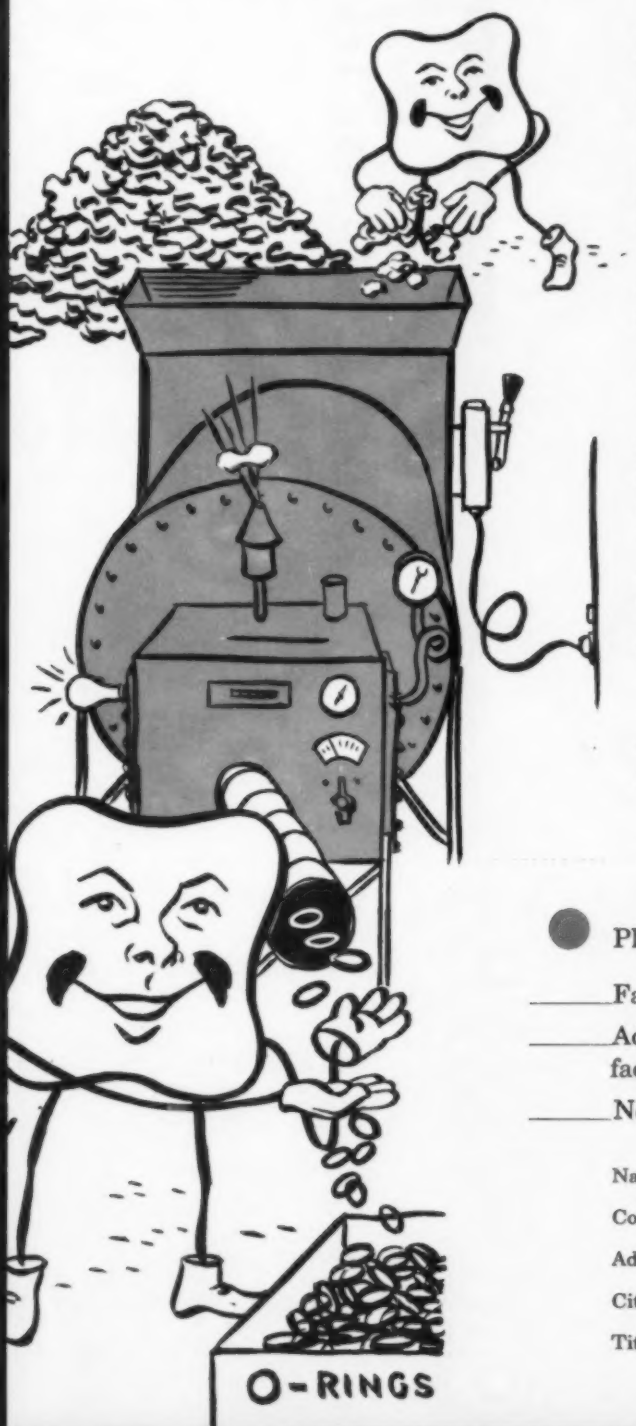

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It permits complete automation in production of O-rings, producing a part that has many outstanding features.

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2	1/16	3/16	5/16	.050	.042±.005	112.00	53.50	38.50	32.00	36.50	24.00	23.00	21.00
3	1/16	5/16	7/16	.050	.060	109.00	50.50	37.50	31.00	36.00	23.50	21.50	18.00
4	1/16	7/16	9/16	.070	.070	107.00	48.50	36.50	30.00	25.50	23.00	21.00	19.50
5	1/16	9/16	11/16	.070	.070	114.00	55.00	39.00	33.00	28.50	24.50	22.00	21.50
6	1/16	11/16	13/16	.070	.100	104.00	45.00	35.00	29.00	24.50	22.00	20.00	18.00
7	1/16	13/16	15/16	.070	.114	59.00	25.50	20.00	22.50	18.70	18.00	16.50	13.50
8	1/16	15/16	1 1/16	.070	.145	61.00	27.50	21.00	22.50	18.80	14.50	13.50	13.70
9	1/16	1 1/16	1 3/16	.070	.176	66.00	29.50	22.00	23.00	19.00	15.00	13.50	13.90
10	1/16	1 3/16	1 5/16	.070	.208	78.00	40.50	30.50	23.20	19.20	15.40	14.00	14.50
11	1/16	1 5/16	1 7/16	.070	.239	74.00	42.00	31.00	23.70	19.50	15.70	14.20	15.00
12	1/16	1 7/16	1 9/16	.070	.301	75.00	42.50	32.50	23.90	19.70	16.00	14.50	15.00
13	1/16	1 9/16	1 11/16	.070	.364	77.00	44.00	30.50	24.00	19.80	16.20	14.70	15.50
14	1/16	1 11/16	1 13/16	.103	.362	81.00	46.00	31.00	24.20	20.00	16.50	15.00	16.50
15	1/16	1 13/16	1 15/16	.103	.424	85.00	47.50	32.50	24.40	20.20	16.70	15.20	16.90
16	1/16	1 15/16	2 1/16	.103	.487	86.00	48.50	30.50	24.50	20.30	16.80	15.30	17.10
17	1/16	2 1/16	2 3/16	.103	.549	88.00	49.50	31.00	24.60	20.40	16.90	15.40	17.30
18	1/16	2 3/16	2 5/16	.103	.612	90.00	53.00	32.50	24.70	20.50	17.00	15.50	18.00
19	1/16	2 5/16	2 7/16	.103	.674	92.00	57.00	37.00	24.80	20.60	17.10	15.60	18.50
20	1/16	2 7/16	2 9/16	.103	.737	94.00	60.50	38.50	24.90	20.70	17.20	15.70	20.00
21	1/16	2 9/16	2 11/16	.103	.799	96.00	64.00	39.50	25.00	20.80	17.30	15.80	20.50
22	1/16	2 11/16	2 13/16	.103	.862	98.00	66.00	41.00	25.10	20.90	17.40	15.90	21.00
23	1/16	2 13/16	2 15/16	.103	.924	99.00	67.00	42.00	25.20	21.00	17.50	16.00	21.50
24	1/16	2 15/16	3 1/16	.103	.987	102.00	71.50	42.50	25.30	21.10	17.60	16.10	22.00
25	1/16	3 1/16	3 3/16	.103	1.049	105.00	73.50	43.50	25.40	21.20	17.70	16.20	22.50
26	1/16	3 3/16	3 5/16	.103	1.112	106.00	74.50	44.00	25.50	21.30	17.80	16.30	23.00
27	1/16	3 5/16	3 7/16	.103	1.174	108.00	76.00	45.00	25.60	21.40	17.90	16.40	23.50
28	1/16	3 7/16	3 9/16	.103	1.237	110.00	77.50	46.00	25.70	21.50	18.00	16.50	24.00
29	1/16	3 9/16	3 11/16	.103	1.299	113.00	79.50	47.00	25.80	21.60	18.10	16.60	24.50
30	1/16	3 11/16	3 13/16	.103	1.362	116.00	81.50	48.00	25.90	21.70	18.20	16.70	25.00
31	1/16	3 13/16	3 15/16	.103	1.424	117.00	82.50	48.50	26.00	21.80	18.30	16.80	25.50
32	1/16	3 15/16	4 1/16	.103	1.487	119.00	84.00	49.00	26.10	21.90	18.40	16.90	26.00
33	1/16	4 1/16	4 3/16	.103	1.549	121.00	85.00	49.50	26.20	22.00	18.50	17.00	26.50
34	1/16	4 3/16	4 5/16	.103	1.612	122.00	86.00	50.00	26.30	22.10	18.60	17.10	27.00
35	1/16	4 5/16	4 7/16	.103	1.674	124.00	87.50	50.50	26.40	22.20	18.70	17.20	27.50
36	1/16	4 7/16	4 9/16	.103	1.737	125.00	88.00	51.00	26.50	22.30	18.80	17.30	28.00
37	1/16	4 9/16	4 11/16	.103	1.799	127.00	90.00	51.50	26.60	22.40	18.90	17.40	28.50
38	1/16	4 11/16	4 13/16	.103	1.862	128.00	92.50	52.00	26.70	22.50	19.00	17.50	29.00
39	1/16	4 13/16	4 15/16	.103	1.924	129.00	93.50	52.50	26.80	22.60	19.10	17.60	29.50
40	1/16	4 15/16	5 1/16	.103	1.987	130.00	94.50	53.00	26.90	22.70	19.20	17.70	30.00

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3630 Wooddale Ave.
Minneapolis 16, Minn.

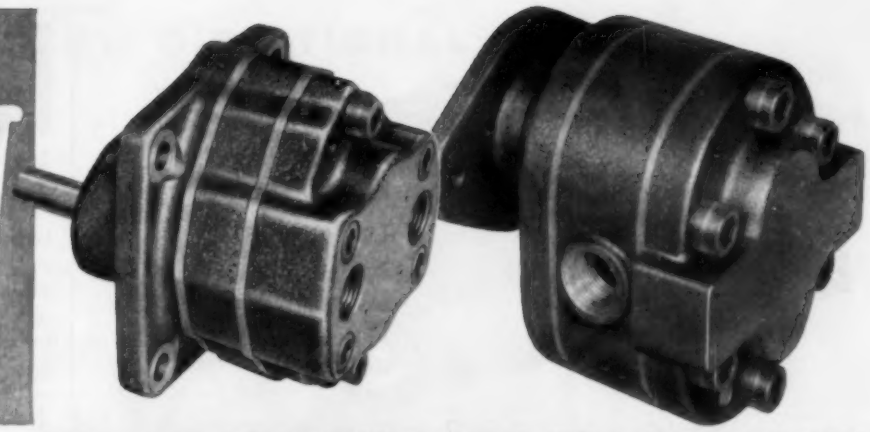
STANDARD MATERIALS SPECIFICATIONS COMPOUND 366Y

Duro-Shore A	70±5
Compression Set % Deflection	
22 hrs. @ 158° F.	5
70 hrs. @ 212° F.	16
70 hrs. @ 250° F.	21

Oil aging volume change	ASTM No. 1	ASTM No. 3
70 hrs. at 212° F	−8.5	+7.3
70 hrs. at 250° F	−8.3	+9.8

High Temp. Limit	
Air	212
Oil	275
Cold Temp. flexible at ° F	−65

NEW



TUTHILL POWERMAX

Hydraulic pumps and Fluid motors

- **For pressures to 1500 psi**
- **Pump capacities from 1.2 to 14.2 gpm**
- **For speeds to 3600 rpm**

TUTHILL, producers of quality pumps since 1927, proudly announces its new line of POWERMAX hydraulic pumps and fluid motors. Produced in a complete selection of seven different models, these rugged, compact new units incorporate the quality construction and advanced engineering that industry has learned to expect from TUTHILL.

POWERMAX pumps and fluid motors use precision-ground, involute spur gears of heat-treated alloy steel, especially designed for efficient and quiet operation. Large, heavy-duty, anti-friction bearings . . . hard, long-wearing, double wear plates of a special bronze alloy . . . double lip-type shaft seals . . . generously proportioned heat-treated alloy steel shaft . . . these are just a few of the many quality construction features which insure long, trouble-free life for POWERMAX pumps and motors.

The compact design of these units saves space and simplifies installation problems. They can be provided for either flange or foot mounting and with either side or rear ports as standard (front porting is available on special order). POWERMAX pumps or motors may be supplied with a built-in relief valve if desired.

Tuthill Manufactures a Complete Line of Positive Displacement Rotary Pumps in Capacities From 1 to 200 GPM; for Pressures to 1500 PSI; speeds to 3600 RPM.

Duplex or tandem models

For applications such as power steering where two pumps of substantially different operating characteristics are required, POWERMAX pumps may be furnished in duplex or tandem models, with both units mounted on a single shaft. This allows substantial savings through the elimination of a second driving source, reductions in hydraulic piping, and lower installation costs.

A new Catalog, No. 111, gives complete information on these new POWERMAX pumps and hydraulic motors. Included are performance curves, dimensional data, construction features . . . all the detailed engineering information you need. Write today for your copy.

TUTHILL PUMP COMPANY
981 East 95th Street, Chicago 19, Illinois

☐ Please forward copy of Catalog No. 111 on new POWERMAX hydraulic pumps and fluid motors.

☐ Please have your representative call.

NAME_____ TITLE_____

COMPANY_____

STREET_____

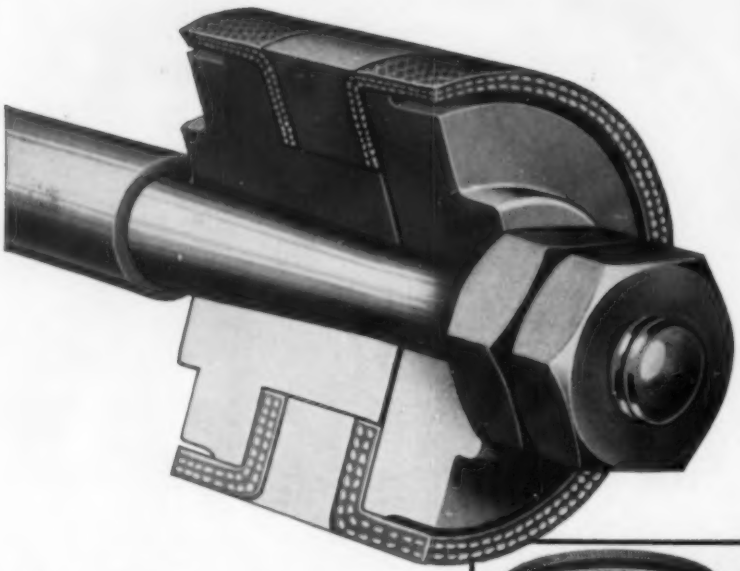
CITY_____ STATE_____

TUTHILL PUMP COMPANY

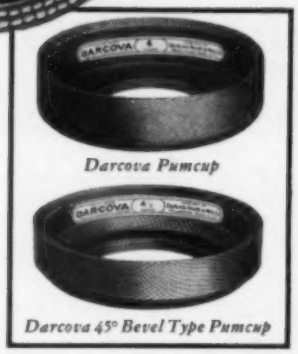
981 East 95th Street, Chicago 19, Illinois
Canadian Affiliate:
Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE

CIRCLE 124 ON READER SERVICE CARD



WHY PUMCUPS MAKE A DIFFERENCE



Darcova Pumcup

Darcova 45° Bevel Type Pumcup

- **in reciprocating pumps**
- **in air and hydraulic cylinders**

With Darcova Pumcups in your cylinders, there's less fluid slippage. High volumetric efficiency is maintained and Pumcups outlast other packings at least 3 to 1! There's less down-time! Lower power cost! Smoother operation! Less maintenance and replacement!

Longer life is the result of truly advanced cup engineering, including 100% nylon composition, plus a choice of types, textures and precision sizes to exactly match fluid, cylinder, pressure and temperature conditions.

These same factors contribute to prolonged high efficiency by permitting full advantage of the "cup principle". Thus fluid pressure always keeps Pumcups snug against cylinder wall, despite eventual wear, while the total frictional load is minimized.

Send for Bulletin 5503. It will give you *all* the facts.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

BRIEFS

for variable volume at pressures to 1000 psi. Mentioning the recently developed temperature-compensated flow control valve, he indicated that this feature is most valuable for flow rates of 10 to 30 cipm. Accurate speed control is very important in getting maximum life from carbide tools.

The biggest objection to hydraulic controls is still leakage, Erskin said. Brazed and drilled manifolds are a help on fixed designs, but even then additional lines to actuators are required. He cited a large transfer line having 109 power units. Even though designers had used manifolds wherever possible, there were still 7000 separate connections. 2000 of these were tapered pipe threads which were giving considerable leakage.

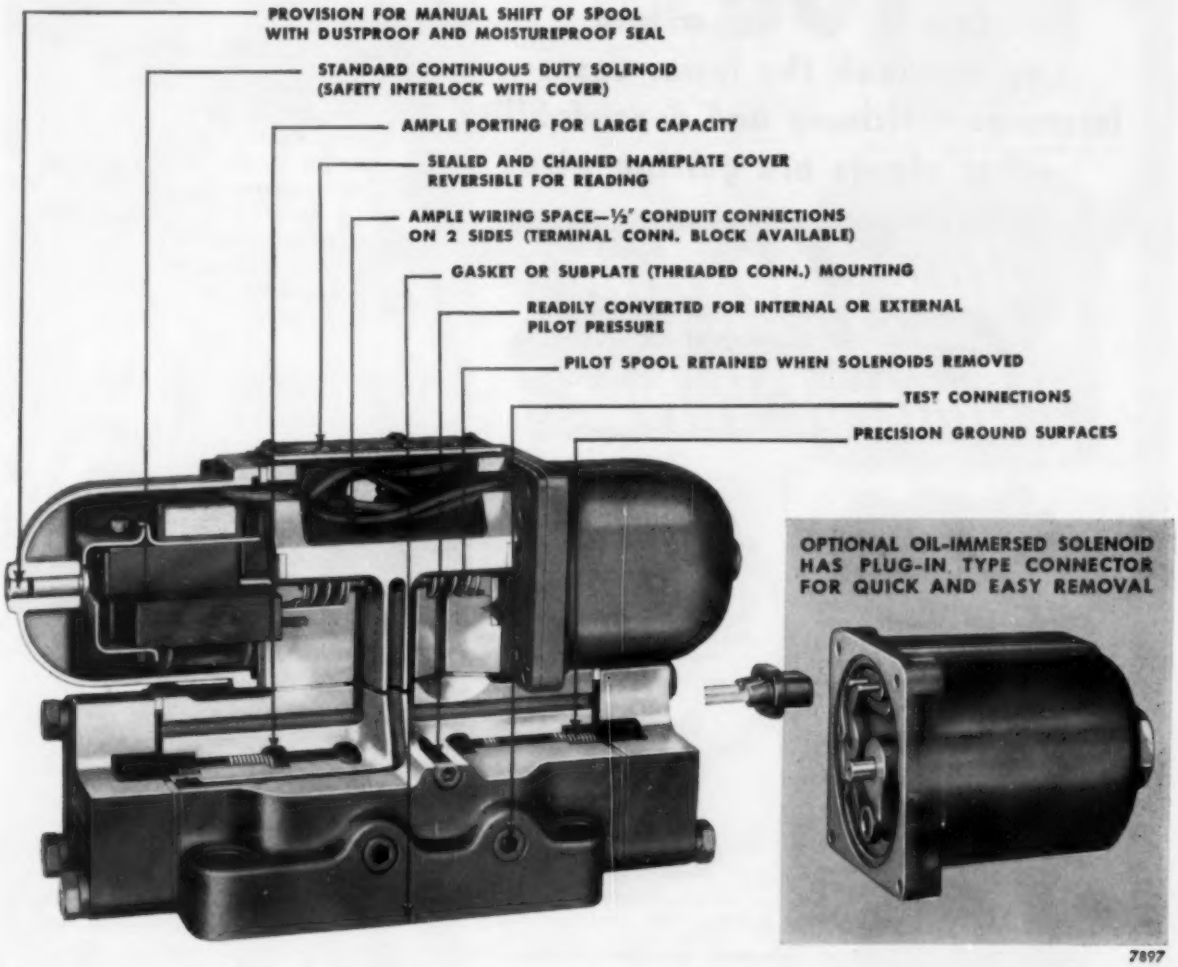
For the future, Erskin said, there is a need for longer life valve actuators. Oil-immersed solenoids may be the answer. These should also be designed for use with low powered static controls.

EXECUTIVES are taking to the air in their own planes to give faster service. Here's Mechanical Air Controls' president, Walter D. Ludwig, who recently earned his pilot's license.

Electro-hydraulic servo valves is an area of rapid development. These will require high capacity, high pressure, full flow filters. For safety on fabricating machines such as presses and die casting machines, Erskine said his company is developing a solenoid valve with integral limit switch which will tie in with the machine's safety interlocking. ▼▼▼

Continued on page 36

Only VICKERS® DIRECTIONAL VALVES Have *All* These Features


PROVISION FOR MANUAL SHIFT OF SPOOL WITH DUSTPROOF AND MOISTUREPROOF SEAL
STANDARD CONTINUOUS DUTY SOLENOID (SAFETY INTERLOCK WITH COVER)
AMPLE PORTING FOR LARGE CAPACITY
SEALED AND CHAINED NAMEPLATE COVER REVERSIBLE FOR READING
AMPLE WIRING SPACE—½" CONDUIT CONNECTIONS ON 2 SIDES (TERMINAL CONN. BLOCK AVAILABLE)
GASKET OR SUBPLATE (THREADED CONN.) MOUNTING
READILY CONVERTED FOR INTERNAL OR EXTERNAL PILOT PRESSURE
PILOT SPOOL RETAINED WHEN SOLENOIDS REMOVED
TEST CONNECTIONS
PRECISION GROUND SURFACES
OPTIONAL OIL-IMMERSED SOLENOID HAS PLUG-IN TYPE CONNECTOR FOR QUICK AND EASY REMOVAL
7897

REDUCED DOWN-TIME
LONGER SOLENOID LIFE
LESS MAINTENANCE
EASIER INSTALLATION

Vickers hydraulic 2- and 4-way valves provide the optimum in directional control. They are compact, versatile, and are designed for heavy duty, continuous and rapid cycling operation on all types of industrial machinery. More than a decade of application experience and years of research and development back all the valves' features.

Seven spool types satisfy a wide variety of circuit needs and operate at pressures to 3000 psi. Optional oil-immersed solenoids operate cooler, increasing service life 20 to 30 times.

Installation is simplified with ease of wiring and a minimum of piping. The valves are available for gasket or sub-plate mounting. Mounting position is unrestricted except in "no-spring" models. The optional oil-immersed solenoid has a plug-in type connector and is available in all standard voltages. Field modification of existing units can be made to incorporate heavy-duty, oil-immersed solenoids.

The valves conform to JIC Standards and are available in ⅛" and ¼" direct solenoid operated models . . . ¾", 1¼", 2", and 3" solenoid controlled pilot operated models. These valves cover the flow range from 1.25 gpm to 320 gpm.

For further information, write for Installation Drawing I-182412.

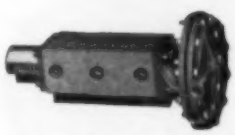
VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1474 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Springfield, N.J.) • PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. • ROCHESTER ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA WORCESTER
FACTORIES ALSO IN AUSTRALIA, ENGLAND AND GERMANY
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto and Montreal

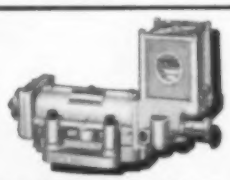
Can **YOU** afford
to overlook the lower costs
increased efficiency and dependability
other plants are getting with

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves

8" Double Pilot Operated 2-way Valve for Plant Water Systems; Pressures to 250 psi.



½" Diaphragm Operated Single Plunger 4-way Air or Hydraulic Valve; Pressures to 250 psi.



½" Single Solenoid 4-way Air Valve; Pressures to 125 psi; (Conforms to "JIC" Standards).

1" Hand Operated 4-way Hydraulic Valve for Oil or Water Service; Pressures to 2,000 psi.

Quick-As-Wink Control Valves are precision instruments:—unsurpassed for controlling all single or sequence machine movements. They are designed better — and made better — to give users unsurpassed efficiency, economy and satisfaction — free from breakdowns. Serviced easily and quickly — in the field — without disturbing any piping. No need to carry large stand-by inventories — or to return valves to the factory for servicing. Hundreds of different types, sizes and actions, including "JIC" designs. Sizes from ¼" to 4". You'll never know how good they are until you try them . . . *Get full details.*

Write for **BULLETIN NO. 571** *Today.*

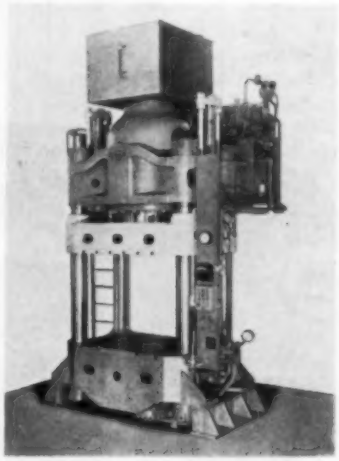
Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves

Mfd. by **C. B. HUNT & SON, INC.,** *1996 East Pershing St., Salem, Ohio*
— Engineering and Sales Representatives in the Principal Cities —

BRIEFS

Small Pump Locks Giant Press

• **Long cycle**—Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has designed and built a self contained oil hydraulic molding press capable of curing for cycle lengths up to 45 minutes. This 1650 ton press is to be used for molding special electrical equipment products.



• **Double pump design**—A large power pump combined with a small holding pump saves horsepower and lowers the amount of heat induced into the oil. On extended pressing cycles oil from the main pump is automatically bypassed and the small holding pump maintains the pressure. This system allows the use of smaller heat exchangers to cool the oil. ▼▼▼

Servo Valve Controls Exciter

This hydraulic vibration exciter is capable of high forces and long strokes previously not obtainable. It has a maximum force of 60,000 lbs, an available stroke of 4 in., and a maximum velocity of 14 in. per sec in the frequency range of 1 to 150 cps.

The exciter has 5 basic components: the driving cylinder, hy-

Continued on page 40

RMC Instruments for Hydraulic Pressure Systems

Tell us your requirements for indicating instruments or actuating switches and let RMC engineering skill go to work for you.

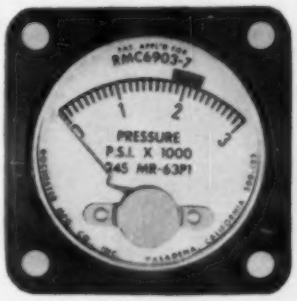
ROCHESTER
MANUFACTURING CO., INC.
209 ROCKWOOD ST.
ROCHESTER 10, N. Y.

RMC
LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

HIGH PRESSURE GAUGES

The RMC-Lindsay gauge, designed for pressures from 1,000 to 15,000 PSI, is a multiple coil, helical Bourdon tube type. The pointer is attached direct to the tube, without linkages or pivots. This gauge is made for extensive cycling, and will meet rigid vibration and over-pressure requirements—can withstand extreme conditions of shock, vibration or temperature. These gauges are made in various models to meet specified pressure requirements for a wide range of applications, including guided missile and jet aircraft service.

MODEL #6903-7 (Actual Size)



MODEL #6901
(Actual Size)

PRESSURE GAUGES

MODEL #2650—RMC pressure gauges are capable of withstanding very high overload pressures above a nominal scale reading. Various types are available in different models, sizes, etc. All are built for use on heavy-duty equipment, to maintain accurate readings regardless of mechanical vibration, or exposure to dust and weather.

PRESSURE/VACUUM SWITCHES

MODEL #2900—The RMC 2900 series is designed for service on vibrating equipment. Mechanism is sealed dust-proof and watertight. The diaphragm is Buna N impregnated and calibrated at the factory to close or open a contact at fixed pressure (or vacuum) values. Double or single terminal models. Pressures from 4 to 100 PSI. Vacuums from 4 to 26 in. Hg.

THERMOMETERS

MODEL #1848—RMC's general line of industrial thermometers cover just about every possible application. All are of stainless steel construction, with hermetically sealed dials. They are factory calibrated and pressure tested. External dial reset device permits on-the-job calibration for pin-point accuracy.

CIRCLE 102 ON READER SERVICE CARD

SAVE TWO WAYS WITH NEW HI-CAPACITY Fulflo Filter

Model WH Hi-Capacity Fulflo Filter with optional Cover-Lifting Device and Pressure Gauges. Note compactness and simplicity of inner assembly.

The completely new Hi-Capacity Fulflo Filter brings you substantial savings through positive protection of hydraulic circuits — plus *lower-than-ever initial cost.*

This compact sturdy steel filter is available in a full range of sizes — with from 24 to 270 10-inch Honeycomb Filter Tubes. Brand new cover is fastened by sturdy bolts which swing down when loosened to release cover for easy access to filter tubes. Optional Cover-Lifting Device enables cover to swivel aside for even speedier servicing.

Another outstanding advantage — all standard models are designed for *operating pressures up to 150 psi.* Higher pressure models are engineered to order.

The new Model Fulflo Filter provides continuous micro-clarity, at minimum pressure drop, for all types of hydraulic fluids. It will not remove additives. Exclusive Honeycomb Filter Tubes provide true *depth* filtration through hundreds of filtering tunnels, precision engineered for uniformity of size, shape and depth. Tubes are available in a wide range of positively controlled densities and in a variety of natural and synthetic fibres.

Fulflo Filters are engineered to your exact requirements. For folder on the new Model WH, write to Department AH.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo Filters — *with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.*

CFC Filters — *Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.*

Rubber Bonded-to-Metal Parts

Precision know-how, care, and special bonding techniques assure you of parts that will reduce assembly costs, improve product operation and simplify design.

Just send your problems—your blueprints to Precision for solution. Our engineering staff will be glad to make recommendations and quote to your requirements.

Specify Precision — first in quality

Precision Rubber Products Corporation

"O" Ring and Dyna-seal Specialists

Dept. 1, Oakridge Drive, Dayton 7, Ohio **Canadian plant at: Ste. Thèrése de Blainville, Québec**

SIMPLE DESIGN = LOW COST

This SECO radial-piston hydraulic pump provides the high performance characteristics of the piston-type pump at a price usually associated only with pumps of vane or gear design. If you use vane or gear pumps because of *price*, this SECO series "D" pump will give you more for your money.

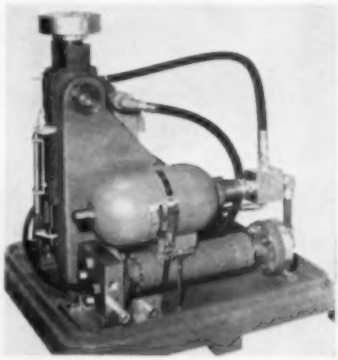
The Model D-5 pump illustrated is rated at 2000 PSI maximum – 5 GPM – at 1800 R.P.M. – using 235 SSU oil at 100°F. The over-all efficiency is above 90% for a wide range of operating conditions.

SECO FLUID POWER

SIMPLEX ENGINEERING CO.
Subsidiary of RACINE HYDRAULICS & MACHINERY, INC.
ZANESVILLE, OHIO

BRIEFS

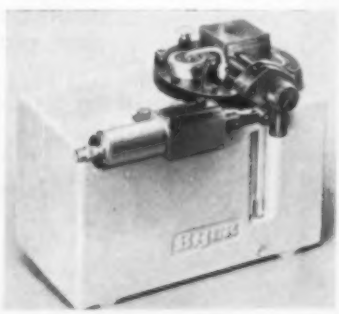
draulic accumulator, high pressure hydraulic pump, electronically controlled servo valve, and



an electronic control system. The limits of force, stroke and frequency are determined by the capacities of the servo valve actuating cylinders and the pump output. Made by MB Manufacturing Co., Division of Textron Inc., New Haven, Conn. ▼▼▼

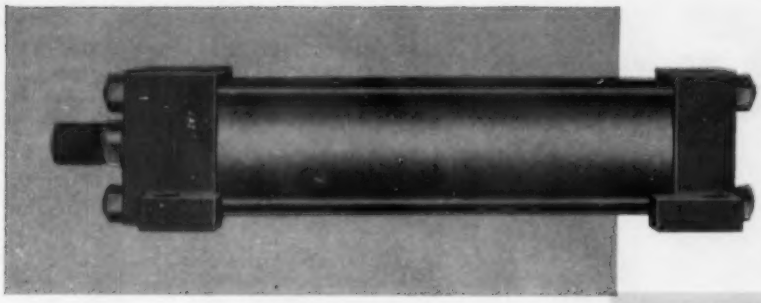
Hydraulic Oil Feeds Lube Oil

Lubrication of presses and machine tools using hydraulic systems can be done with the Bijur Cyclic "Y" lubricator. It works by applying hydraulic pressure to a spring-



loaded cylinder. The rod is connected to a piston type, metering lubricator. With each hydraulic impulse, the lubricator delivers from .01 to 2.0 cc of lubricating oil, depending on the setting. It will operate on hydraulic pressures from 150 to 3,000 psi. Made by Bijur Lubricating Corp., Rochelle Park, N. J. ▼▼▼

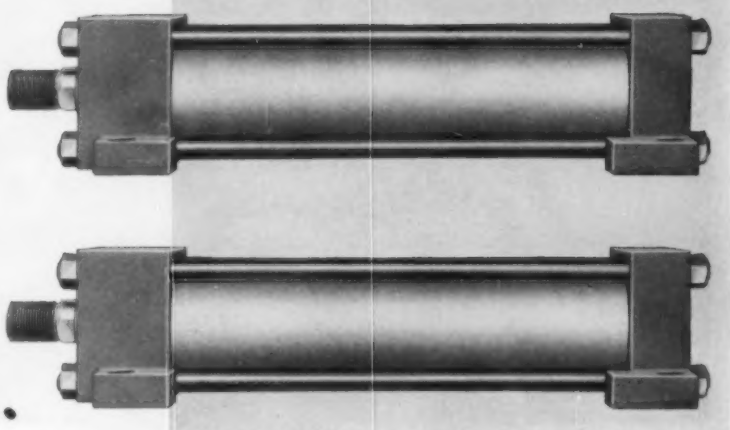
Continued on page 42



A LOGAN SUPER-MATIC CYLINDER

2 competitors' cylinders

do they LOOK ALIKE? ...sure they do on the surface...



...BUT LOOK AT Logan's BIG EXTRA PLUS VALUES

Logan Super-Matic Cylinders

are made to interchange with other leading manufacturers' cylinders . . .

1. Logan designs assure the service required for those extra-rugged applications.
2. Over FORTY YEARS of cylinder manufacturing know-how.
3. Built by CRAFTSMEN whose average service record with LOGAN is more than 20 years.
4. Manufactured in a plant which applies the most modern production methods.

FREE

SEND FOR THE "LOGAN CALCULATOR"

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
832 CENTER AVENUE, LOGANSPORT, INDIANA

PLEASE SEND COPY OF CATALOG:

- ☐ 100-1 AIR CYLINDERS
- ☐ 100-2 MILL-TYPE AIR CYLS.
- ☐ 100-3 AIR-DRAULIC CYLS.
- ☐ 100-4 AIR VALVES
- ☐ 100-5 LOGANSQUARE CYLINDERS
- ☐ 100-6 ULTRAMATION CYLINDERS
- ☐ 300-2 PRESSES
- ☐ FACTS OF LIFE
- ☐ 200-1 HYD. POWER UNITS
- ☐ 200-2 ROTOCAST HYD. CYLINDERS
- ☐ 200-3 750 SERIES HYD. CYLINDERS
- ☐ 200-4 AND 200-7 HYD. VALVES
- ☐ 200-6 SUPER-MATIC CYLS.
- ☐ 300-1 CHUCKS
- ☐ ABC BOOKLET
- ☐ CIRCUIT RIDER

TO:

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

450 GPM

New 4" Solenoid operated Pilot Controlled Four-way valve handles 450 gpm at 15 ft/sec. Six spool types with adjustable choke pilot end covers.

This ⅛" four-way valve is the smallest in the H-P-M line and handles 2 gpm at 15 ft/sec. velocity. Six spool types.

BIG or small H-P-M gives You One Source for Complete Satisfaction

Whatever your needs, H-P-M has the experience and the hydraulic components to handle your requirements. Big or small—standard or special—call your H-P-M Hydraulic Power specialist in your area or write headquarters at Mount Gilead. Valves to 700 gpm also available.

H813

HPM

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. COMPANY
A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U. S. A.

BRIEFS

No Strain On Your Back

1. A hand pump does all the heavy work of opening the side walls on mobile workshop. Two

long, single-acting rams raise and give support in the center of each side wall. Struts lock and support the ends.

Hand pump is a compact unit which includes reservoir, and directional control valve. Couse Manufacturing, Inc., Newark, N.J. builds this shop.

2. The wife can launch your boat with this rig. If she hurries, the

boat can be afloat in 5 seconds. Muscles on this boat launch are provided by a 1½-ton hydraulic jack. Northern Welding Service, Alpena, Mich. builds the launcher.

▼▼▼

Machine Tool Synchronized with Transfer Machine

An unusual automated machining line combines a 4-station, center column machine tool, automatically feeding an in-line, transfer machine. It was designed for automotive axle housings. A hydraulic arm unloads the semi-finished housing from the center column machine and loads it on the

Continued on page 44

CIRCLE 61 ON READER SERVICE CARD

CIRCLE 127

variable speeds direct from standard AC power lines...with

U.S. VARIDRIVE MOTORS

Smooth, stepless speed changes to the split RPM—with the simple, completely self-contained U.S. VARIDRIVE MOTOR! Just plug into any standard AC power line.

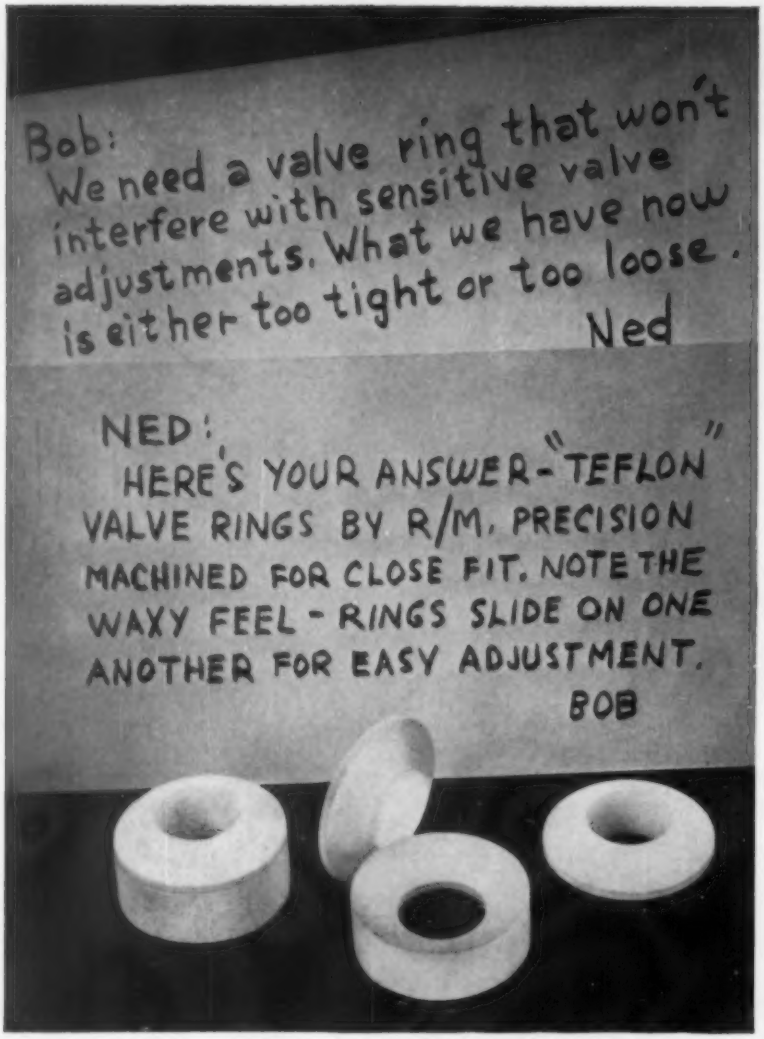
Why bother with DC Converter, DC Generators, complicated electronic tubes and circuits that require special technicians? Why risk costly production shutdowns?

You avoid complications when you choose U.S. VARIDRIVE—dependable, simple, easy for ordinary personnel to maintain. Available in RATINGS ¼ TO 60 H.P. Specify: "U.S. VARIDRIVE MOTOR."

U.S. ELECTRICAL MOTORS INC.

P. O. BOX 2058, LOS ANGELES 54, CALIFORNIA
OR MILFORD, CONNECTICUT

FREE COLOR-ILLUSTRATED BROCHURE
...Send for U.S. Varidrive Bulletin 1797


Bob:
We need a valve ring that won't interfere with sensitive valve adjustments. What we have now is either too tight or too loose.
Ned
NED:
HERE'S YOUR ANSWER - "TEFLON" VALVE RINGS BY R/M. PRECISION MACHINED FOR CLOSE FIT. NOTE THE WAXY FEEL - RINGS SLIDE ON ONE ANOTHER FOR EASY ADJUSTMENT.
BOB

"Teflon"* Valve Stem Packings are just what you need when you are making sensitive adjustments on slow moving rotary and reciprocating equipment. The precision machined rings slip on each other and exert pressure against the valve stem or rod. Because it does not react to any known chemical and has no known solvent, "Teflon" is ideal where corrosion is a problem. It has excellent nonadhesive properties—an added benefit if you are handling viscous fluids. "Teflon" Valve Stem Packings are supplied in wedge and angular type and as solid unit rings.

R/M also manufactures a complete range of homogeneous and reinforced valve stem packings engineered to meet many other requirements: high temperatures, high pressures, high speeds, temperature extremes, etc.

Feel free to call on the experienced R/M packing engineers for details and service, whatever your packing needs.

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS—including Vee-Flex®, Vee-Square®, Universal Plastic, and "versi-pak"®; GASKET MATERIALS; and "TEFLON" PRODUCTS. SEE YOUR R/M DISTRIBUTOR.

*A. Du Pont trademark

R/M

PACKINGS

RAYBESTOS-MANHATTAN, INC.

PACKING DIVISION, PASSAIC, N.J.

MECHANICAL PACKINGS AND GASKET MATERIALS

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings Brake Blocks • Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

BRIEFS

transfer machine. It is then automatically clamped and passes through the 17 stations of the transfer machine. The line will machine 75 axle housings per hour. It was designed and built by Snyder Tool & Engineering Co., Detroit, Mich. ▼▼▼

Weatherhead Announces $15,000 Contest

"We believe that engineers, production and maintenance men have much technical know-how which, if shared, can be of great value to industry. With the hope of uncovering some of this know-how, we are offering $15,000 in

G. P. Robers

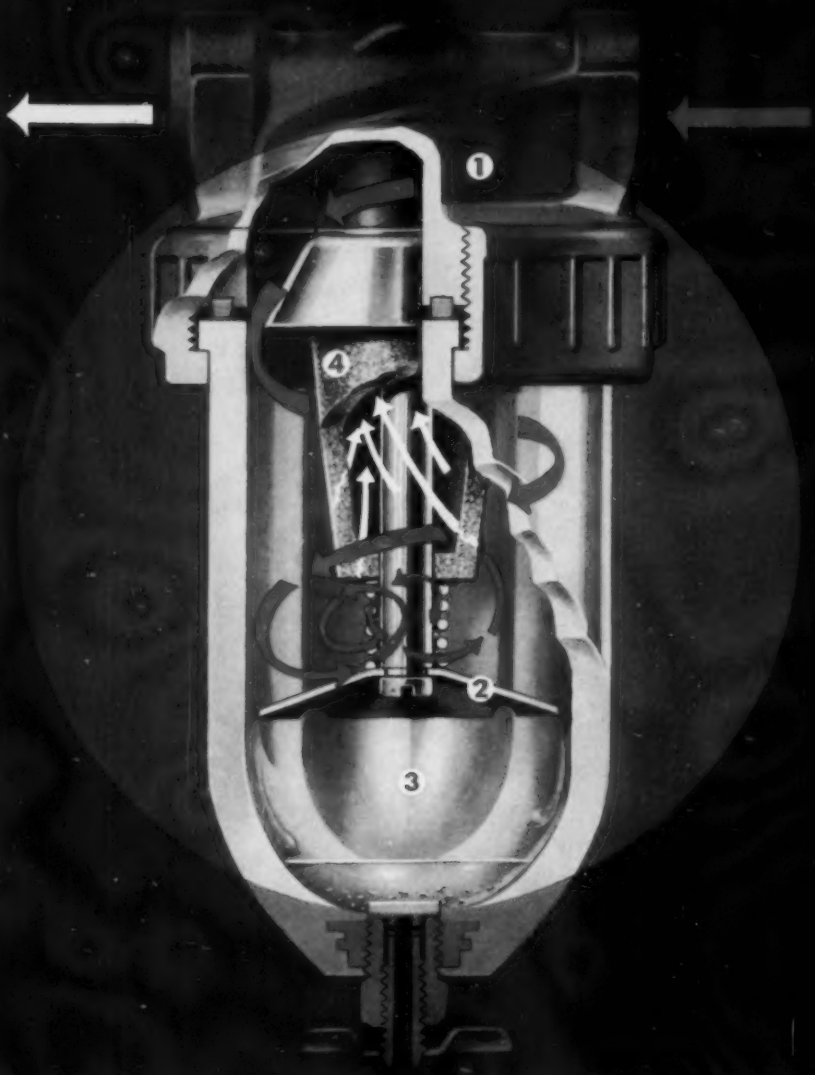
cash prizes for case histories on Weatherhead, flareless, Ermeto, high pressure tube fittings." This was the comment of G. P. Robers, Weatherhead's general sales manager of the industrial distributor division as he announced this case history contest.

The contest is open to everyone who is active in the design, maintenance or operation of equipment. First prize is $1500, 2nd prize is $1000; next 8 winners, $750 each; next 35, $100 each; next 40, $50 each, next 100, $10 each. Contest closes at midnight, September 30th.

Weatherhead distributors can provide additional information. Entries should be sent to: Win With Ermeto Contest, P.O. Box 2457, Fort Wayne, Indiana. ▼▼▼

CIRCLE 98 ON READER SERVICE CARD

CIRCLE 137 ⟶



Curved inlet (1) directs incoming air in downward helical pattern. Larger impurities and condensate are "thrown out" by centrifugal action, collecting on bowl sides and spiraling downward past baffle (2) into quiet chamber for draining-off. Baffle traps sediment in quiet chamber (3) and allows only dry air centrifugally cleaned of larger impurities to reach filter element (4) where finer particles are filtered out.

New "TORNADO ACTION" of high-efficiency filter really cleans air flowing to pneumatic equipment

You add service life to equipment and reduce maintenance costs to the minimum with Watts High-Efficiency air line filters. The exclusive Tornado Action designed into Watts filters delivers really *clean* dry air.

You can expect *high efficiency* from the advanced-design Watts line of filters, regulators and lubricators. Specialists in protection and control devices since 1875, Watts is creating new *standards* of efficiency in pneumatic operation.

WATTS REGULATORS — sensitive "ASPIRATOR ACTION" maintains more uniform pressure

Aspirator acts directly on diaphragm giving instant compensation for fluctuating loads . . . provides precise control and stabilizes pressures reaching individual pieces of equipment.

WATTS LUBRICATORS — exclusive "BY-PASS PICK-UP" assures efficient lubrication

High velocity venturi section provides efficient atomization at air flow rates as low as 1 CFM. Automatic bypass valve assures complete atomization with negligible pressure drop at high air flow rates. Result: wide range performance *in a single unit.*

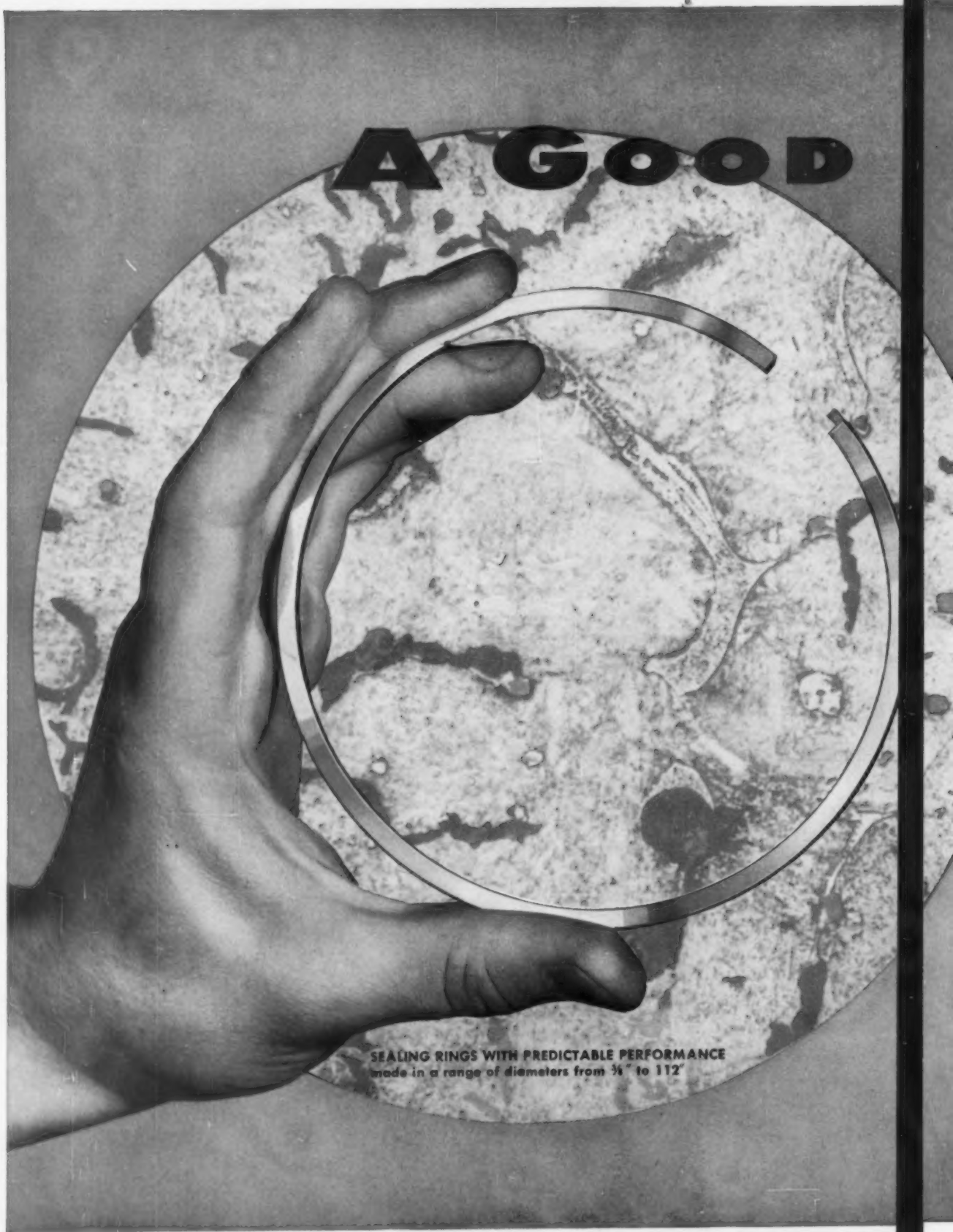
Write for free technical catalog. Charts, diagrams, and performance data enable you to specify the correct Watts pneumatic equipment.

WATTS

FILTERS
REGULATORS
LUBRICATORS

YOUR SAFE SPECIFICATION

Watts Regulator Company — Industrial Division — 6 Embankment Road — Lawrence, Massachusetts


A GOOD
SEALING RINGS WITH PREDICTABLE PERFORMANCE
made in a range of diameters from ⅛" to 112"

GRASP

Koppers knows the importance of proper material selection in producing reliable piston ring and seal performance

Predictable sealing performance results when Koppers matches its knowledge of materials performance to your operational requirements. Koppers pioneering in static and centrifugal casting of iron and alloys . . . as well as its recent leadership in the use of plastics in rings . . . results in a background of applications that cannot be equaled.

Koppers piston rings, sealing rings and seals have been selected as standard equipment in hydraulic actuators, butterfly valves, bearings, transmission controls, fuel pumps, hot air valves and fuel injectors. Koppers can solve your sealing problems. Write us stating your problem today. KOPPERS COMPANY, INC., 1505 Hamburg Street, Baltimore 3, Maryland.

KOPPERS

PISTON AND SEALING RINGS

Engineered Products Sold with *Service*

Fluid Dynamics Knowledge gained by Koppers through many years of experience helps solve the most complicated problems involving the control of gases under pressure.

Face Design Knowledge gives Koppers the ability to produce rings and seals that give reliable and economical performance under the most demanding operating conditions.

Materials Knowledge enables Koppers to select the proper material or combination of metals, plastics or ceramics to insure maximum efficiency and length of service.

advertisement

air circuitry:

a sales tool for you

–Air is booming as an industrial control medium. Air Circuitry* has recently been applied to jobs where it never would have been considered a few years ago! Westinghouse pneumatic engineers have designed and installed Air Circuitry systems for original equipment which have boosted production and cut time and labor expenses for a wide variety of industries including electronics, textiles, automobiles, chemicals, and aircraft.

The benefits of advanced air control are well known among plant engineers. But you can apply these advantages with the same happy results in *your design* of machinery used in manufacturing operations.

SELLING ADVANTAGES–No other medium offers such safety . . . such dependability. Above all, only air can offer such economy: the medium is free and available in limitless supply; the devices are not expensive; and repairs can be made easily by unskilled personnel. These are all-important factors–factors which *sell* factory and machine shop supervisors!

SEE FOR YOURSELF. We'll send a qualified control engineer to your plant. He will show you if and how pneumatic control can improve your present design, and he'll estimate the cost of conversion. If we can't give you simpler, more reliable controls, you don't owe us a cent; our service is free.

Let us study your control systems. Let us improve them, with air. Just write to Westinghouse Air Brake Company. Industrial Products Division, Dept. GL5, Wilmerding, Pennsylvania. Give us a description of your line of machinery, and the type of control it is now using. We'll do the rest.

Remember, Westinghouse has led the world in the design and manufacture of pneumatic devices for more than 90 years. We bring world-wide experience to the solution of your control problems. We bring world-wide service to those who use machines equipped with Westinghouse Air Circuitry.

*AIR CIRCUITRY is the Westinghouse term for application of pneumatic control systems to industrial production operations.

Series 101A
150 psi Air
1500 psi Hydraulic
Meet JIC Standards
Fit where
others won't!

O-M Cylinders give power new dimensions in close quarters

Compared with cylinders of conventional design, having the same size bore, and activated by the same operating pressure, O-M's original Internal Key-type Cylinders develop more power in ⅓ less space on both air and hydraulic circuits.

These compact, powerful components, that fit where others won't, are ruggedly constructed to stand up under protracted service within a wide range of operating pressures. The O-M Internal Locking Key simplifies disassembly, inspection, and service with no alignment problems in reassembly. Besides, the ports can be oriented to any position.

The unique O-M design also assures maximum versatility. By using a majority of standard parts, you get the advantage of "special" cylinders designed to do your job better at a very nominal cost over standard cylinders. These and other engineering advantages and economies of O-M Internal Key-type Cylinders suggest uses in a wide variety of original equipment.

O-M Internal Key-type Air and Hydraulic Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy-duty rods. Completely interchangeable parts and mounts. Immediate delivery on many sizes.

Mail Coupon TODAY *for Bulletins 101A (O-M Internal Key-type Air and Hydraulic Cylinders), and 105 (O-M Series T-H Heavy-Duty Hydraulic Cylinders).*

ORTMAN-MILLER MACHINE COMPANY
1143rd Street, Hammond, Indiana

☐ Have representative call
☐ Send Bulletins 101A and 105

Name_____ Position_____

Company_____

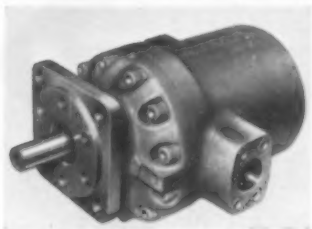
Address_____

City_____ Zone____ State_____

NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

HYDRAULIC PUMP/MOTOR UNITS . . . for 2000 psi



Designation: Model A

Specifications: When used as pumps they are for continuous operating pressures of 2000 psi, with surge pressures to 3000 psi. Capacities are from 7.5 to 12 gpm at rated speed of 1200 rpm.

The same units used as motors, provide maximum torque at stall and contant torque output with a flat curve from 0 to maximum rpm. The motors are reversible and will carry overhung chain or belt loads.

Berry Hydraulics Div.
Oliver Tyrone Corp.
Pittsburgh, Pa.

CIRCLE 300 ON READER SERVICE CARD

IN-LINE FILTER . . . has bronze or stainless steel element

Features: Filter elements are available in 5-12, 12-25, 25-50, 50-125, and 150-200 micron sizes. The body of the filters can be supplied with ⅛, ¼, ⅜, or ½ in pipe threads. Both stainless steel and brass elements are replaceable. Filter has a maximum operating pressure of 5000 psi and can be furnished with brass or stainless steel body.

Hoke, Incorporated
Englewood, N. J.

CIRCLE 301 ON READER SERVICE CARD

HYDRAULIC POWER PACK . . . weighs 7½ lbs.

Features: The package contains a pressurized reservoir, a Dynacor pump, a replaceable filter element, a relief valve, and a piston type accumulator charged with an inert gas.

Application: Servo systems and other circuits requiring a small accurate source of hydraulic power.

Applied Dynamics Laboratories, Inc.
Natick, Mass.

CIRCLE 302 ON READER SERVICE CARD

PILOT CHECK VALVE . . . for air service

Designation: PM-294

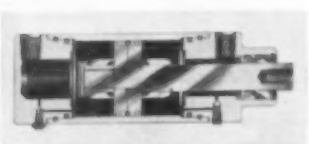
Operation: Valve allows free flow in the direction of the arrow and also in reverse direction, as long as a minimum of 3 psi back pressure is available. With no back pressure, valve acts as ordinary check valve.

Application: In a circuit where two or more 3-way valves control one cylinder it allows each directional valve to extend and retract the cylinder without loss of air out the exhaust port of the other valves.

The Prime Mfg. Co.
Milwaukee, Wis.

CIRCLE 303 ON READER SERVICE CARD

AIR AND OIL CYLINDERS . . . for high temperatures



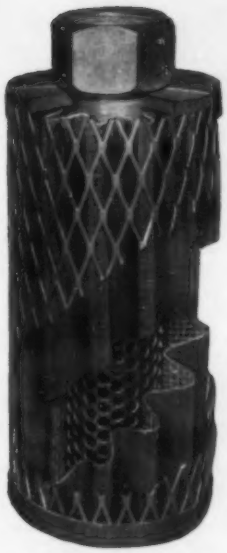
Features: They were designed to withstand continuous high temperatures in applications such as heat treating, furnaces, foundries, and die casting.

Design: Rod end packing consists of spring-loaded V packing lubricated by high temperature silicone grease located in grooves adjacent to the packing. Piston packing consists of two piston rings with an O-ring between them. Cylinders are rated at 150 psi air and 350 psi hydraulic.

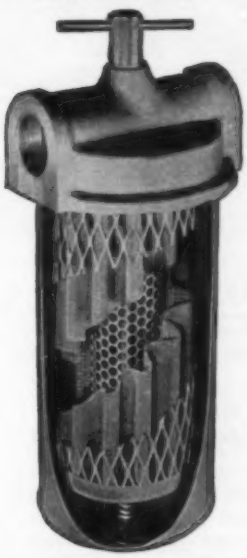
Carter Controls Inc.
Lansing, Ill.

CIRCLE 304 ON READER SERVICE CARD

Continued on page 52



SUMP TYPE (cutaway)



LINE TYPE (cutaway)

MARVEL Synclinal FILTERS

are Standard Equipment!

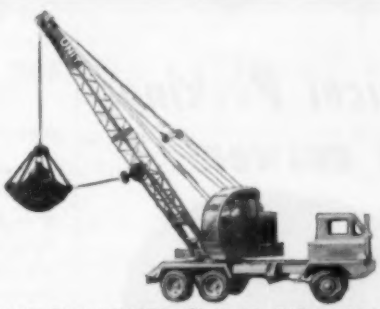
Illustrated below are a few but a representative group of heavy Construction and Road Building equipment on which the manufacturers install Marvel Synclinal Filters as standard equipment.

"PAYLOADER" TRACTOR-SHOVEL Model HH
The Frank G. Hough Co. Libertyville, Ill.

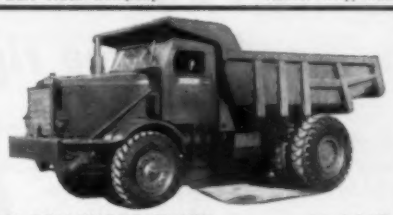
PIPPIN EXCAVATOR and ANGLING BULLDOZER
Pippin Construction Equip. Inc. White River Junct. Vt.

FRONT END LOADER
Ottawa Steel Products Ottawa, Kans.

25 TON DART TRUCK Model 25 SL
Dart Truck Company Kansas City, Mo.



UNIT CHALLENGER 3/8 YARD EXCAVATOR
Unit Crane & Shovel Corp. Milwaukee, Wis.



22 TON EUCLID TRUCK Model TD
Euclid Road Machinery Co. Cleveland, Ohio

OVER 800

Manufacturers of equipment utilizing Hydraulic or other low pressure circulating systems install Marvel Synclinal Filters as Standard Equipment.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation as described in catalog. Choice of Monel mesh sizes range from coarse 30 to fine 200.

MEET JIC STANDARDS

EASY TO CLEAN

Both sump and line types may be easily disassembled, cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

Catalogs containing complete data available on request

IMMEDIATE DELIVERY!

MARVEL ENGINEERING COMPANY

7227 N. HAMLIN AVE.,
CHICAGO 45, ILLINOIS
Phone: JUNIPER 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated (AH-5)

- ☐ Catalog #108—For Hydraulic Oils, Coolants, Lubricants
- ☐ Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- ☐ Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- ☐ Catalog #301—For Water

Name ..... Title .....

Company .....

Address .....

City ..... State .....

A packing problem?

specify PAGE Mechanical Packings and get the right answer

If you find yourself with a packing problem, why not call in one of Page's packing experts and let him help you.

Whether the job calls for packings of Oak, Chrome or Retan, treated with any one of many impregnations, coatings or special finishes . . . or whether synthetics will work better . . . you know you can count on Page for quality and service.

Page offers you a complete line of U's, V's, Flanges, Cups, and O-rings, backed up by nearly a century of experience and complete facilities for production of one or thousands.

- for temperatures to 225° F.
- long life
- low cost
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PAGE BELTING CO. trademark

PAGE BELTING COMPANY
established 1868

Concord — New Hampshire

Page Packings — engineered to do a better job

NEW PRODUCTS

PNEUMATIC TEST STAND
. . . tests under high pressure

Designation: KC-1056

Features: Stand was designed for the testing of industrial and aircraft components. It has three stations equipped with pressure gages and controls. A 5000-psi, 4-stage compressor delivers 15 cfm air through

a dryer to provide dew points below —65 degrees. Completely automatic drying is also possible. A safety feature prevents tampering with the components while under pressure. Testing may be observed through bullet-proof glass doors.

A 6000-psi air bottle provides storage, reducing the on and off cycles of the compressor.

Kahn and Company, Inc.
Hartford, Conn.

CIRCLE 305 ON READER SERVICE CARD

LOW OIL CUT-OFF
. . . protects air compressors

Features: Float controlled switch actuated by air that is released from the centrifugal unloader when the compressor stops. When the switch

breaks the motor circuit compressor will not run again until reset button is depressed. After resetting, compressor will not run through more than one cycle unless oil is added.

Champion Pneumatic Machinery Co.
Princeton, Illinois

CIRCLE 306 ON READER SERVICE CARD

Continued on page 54

CIRCLE 88 ON READER SERVICE CARD

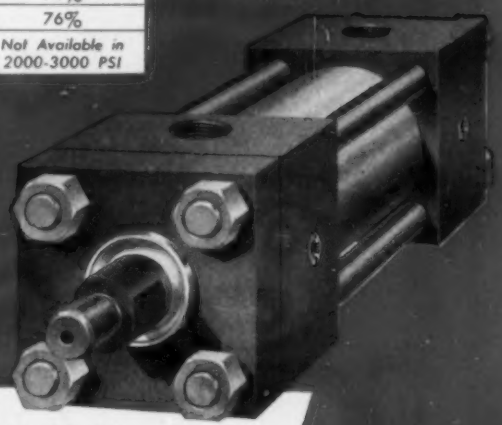
CIRCLE 78

Save 27% or more in cost...

NEW Miller "JOB RATED" HYDRAULIC CYLINDER LINE

JOB RATED, MODEL "J"

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*



with IDENTICAL seals, design, and safety factors as the famous Miller "Power-Packed" Model "H" Line for 3000-5000 psi service.

SEAL FAILURE MEANS CYLINDER FAILURE!

1. *No seal made of synthetic rubber is compatible with even 50% of available, commercial, petroleum base hydraulic fluids.*

MILLER Uses All Teflon* Seals to Eliminate External Oil Leakage because Teflon is impervious to all known hydraulic fluids, even fire-resistant types.

TEFLON SHEF SEAL At Tubing Ends

No blind assembly. Is
Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON Seals On Piston Rod And Bushing

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON Seals On Ball Check And Adjusting Screw

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

NOW! . . . You can save MORE with quality Miller "Job-Rated" Cylinders than with cut-price, lesser quality hydraulic cylinders. And the "Job-Rated" Cylinders are also available under the same immediate shipment program as the Power-Packed Line (2 hours if necessary—3 days normal).

MILLER Uses Resin-Impregnated Leather Piston Cup Seals because they are compatible with petroleum base fluids and some fire-resistant types. Teflon cups available at small extra cost.

2. *Nicked or scored piston rods cause seal failure*

MILLER Uses Case-Hardened Chrome-Plated Piston Rods because they prevent nicks, scoring and rust.

*du Pont trademark for tetrafluoroethylene resin which withstands temperatures from −100° F. to +500° F. and all hydraulic fluids.

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal
PAT. APPLIED FOR

OTHER MILLER QUALITY FEATURES
- Rust-Resistant Surfaces
- Interchangeable, Space-Saving Square, 4-Tie-Rod Design
- Precision Honed Barrels

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION

2008 N. Hawthorne Ave., Melrose Park, Illinois

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

NEW
USG "A" LINE
5090 SERIES
HYDRAULIC GAUGES

GRADE A ACCURACY... PREMIUM GAUGE CONSTRUCTION AT THE PRICE OF GENERAL PURPOSE GAUGES...

Now you can buy hydraulic pressure gauges that are sturdier, more accurate, and have the specific quality features you need . . . yet cost you no more than you'd pay for general purpose gauges. These 5090 Series gauges are part of the new USG "A" Line, specifically designed to withstand the frequent shocks, pulsations, and mechanical vibrations—such as found in the operation of hydraulic presses, Diesel or oil field equipment, and the like.

MEET A.S.A. GRADE A STANDARDS—Available in sizes from 3½ to 12 inches, for pressures up to 10,000 psi, these gauges are guaranteed accurate within 1% of scale range for middle (working) half of scale—1½% for remainder.

EXTRA RUGGED CONSTRUCTION—For the severe service conditions found in hydraulic pressure measurements, the 5090 Series gauges embody such design points as:

a **Top quality, 403 stainless steel Bourdon tubes,** produced and quality-controlled in USG's own plant—your assurance of long, dependable service.

b **Extended life of movement,** through wide meshing gears, even under most severe conditions of pulsation and continuous service.

c **Protection from shock on movement,** through spring-loaded link, when pointer returns to zero with sudden release of pressure.

d **Sustained accuracy, reproducibility, and ease of maintenance** through use of USG's patented ARC-LOC movement (stainless steel pinion, nylon-faced stainless steel segment, and deep stainless steel bushings mounted in stainless steel plates.)

Find Your Nearest Distributor in The 'Yellow Pages'

PRICE, IT'S LOW!—You'll have to see the new Series 5090 gauge to believe that it's available without a premium price. Ask your U. S. Gauge distributor for a demonstration today, or write for a copy of new Catalog 305 which describes USG's complete line of industrial gauges.

UNITED STATES GAUGE
DIVISION OF AMERICAN MACHINE AND METALS, INC., SELLERSVILLE, PA.

USG

CIRCLE 129 ON READER SERVICE CARD

NEW PRODUCTS

HIGH PRESSURE FILTER
. . . has cleanable cartridge

Designation: Model AF-500-CM
Features: Filter contains a cleanable, wool-felt cartridge. It is a full

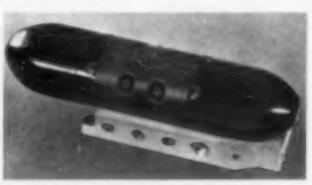
flow filter which gives 5-micron filtration.
Specifications: It is available in two models, 500 and 1000-sq. in. filtering areas, and has a working pressure of 1000 psi.

General Filters Inc.
Novi, Michigan

CIRCLE 307 ON READER SERVICE CARD

SOLENOID CONTROL VALVE
. . . needs no packing

Design: Packing is eliminated on this 4-way valve by maintaining .00005 in. tolerance between the body and spool. Made in single and



double solenoid models the valve is designed for 1000 psi air, water, or oil service.
Features: It features plug-in solenoids and the sub-base mounting has permanently imbedded wiring and a junction box.

Alkon Products Corp.
Hawthorne, N. J.

CIRCLE 308 ON READER SERVICE CARD

For more NEW PRODUCT reviews turn to page 123

the man from Webster...

on your team but on our PAYROLL!

Sound ideal, doesn't it? In practice, it's even better. When you call the man from Webster, you add another expert to your team — a specially trained hydraulics engineer. He knows how to make hydraulics work most efficiently on your product. Another advantage too, is his wide experience with the Webster line of over 100 positive displacement, gear-type pumps and fluid motors . . . standard equipment on products with a reputation for dependability, high performance.

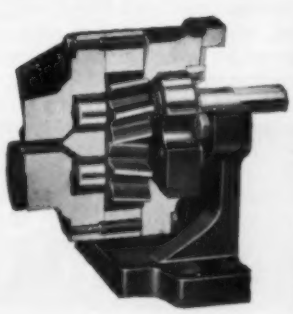
Write or call the man from Webster — a good man to have on your team.

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC
MELROSE 3-3511
RACINE · WIS

OVER 100 MODELS

Capacities: *1/5 to 30 GPM*
Pressures: *Up to 1500 PSI*
Speeds: *Up to 3600 RPM*
Drives: *Direct or Geared*
Torques: *Up to 60 in. lbs./100 PSI*
Available with or without built-in relief valves



H-107

☐ *Have THE MAN FROM WEBSTER contact us—*

- Please send the following -

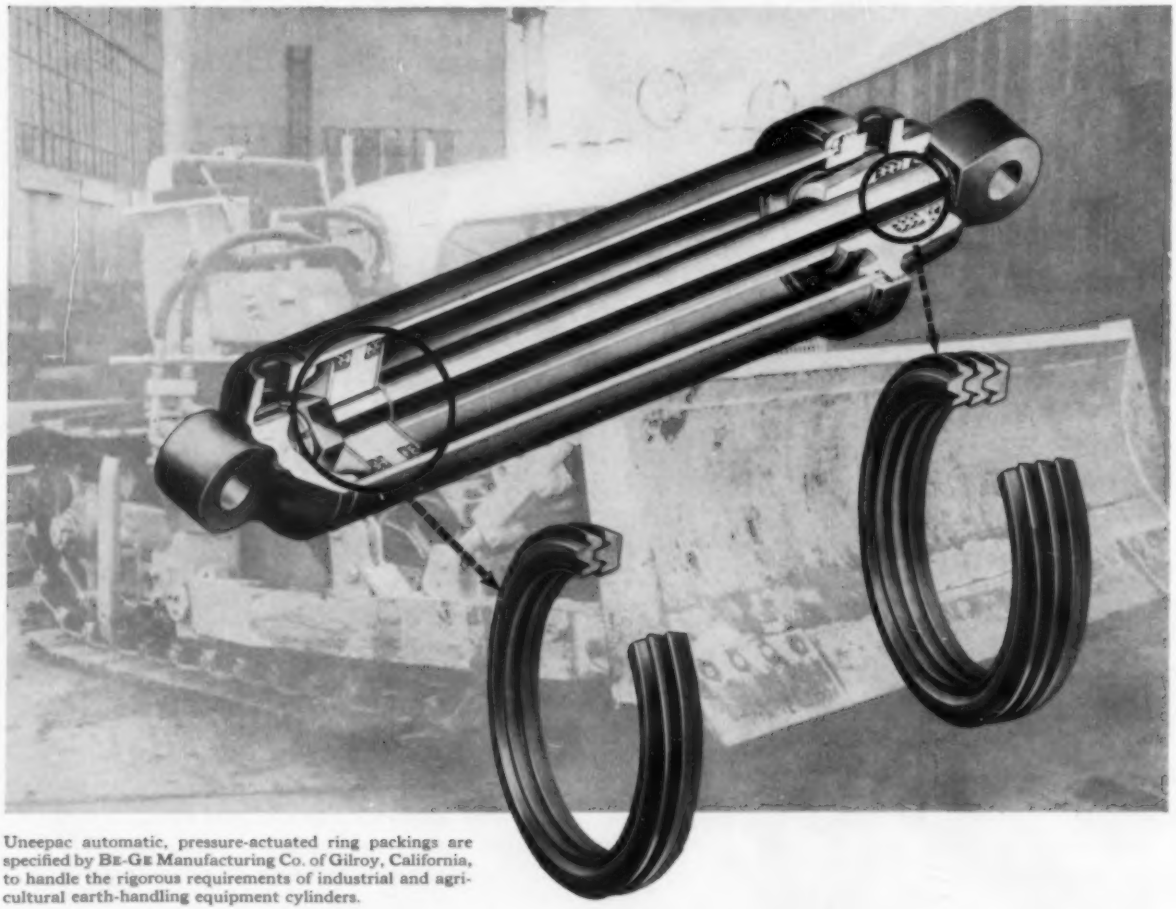
☐ *Complete hydraulic catalog of pumps and valves*

☐ *New information or data as published*

Name _____
Title _____
Company _____
Street _____
City _____ State _____

CIRCLE 139 ON READER SERVICE CARD

Rigorous tests convinced BE-GE to use J-M Uneepac® in their rugged cylinders



Uneepac automatic, pressure-actuated ring packings are specified by BE-GE Manufacturing Co. of Gilroy, California, to handle the rigorous requirements of industrial and agricultural earth-handling equipment cylinders.

Uneepac proves it can handle shock pressures to 4,000 psi in three-year, life-test program

• BE-GE Manufacturing Company's line of cylinders for their hydraulic systems has to stand up to years of day-in, day-out abuse. That's why BE-GE engineers subjected J-M Uneepac Rod Packings to a 350,000-cycle test and Uneepac Piston Packings to a 150,000-cycle test in a three-year program that proved Uneepac can take working pressures to 2,500 psi—shock pressures to 4,000 psi. As proof of performance, Uneepac is now the specification packing on all BE-GE standard—and heavy-duty cylinders.

Pressure-actuated Uneepac Rings offer high-efficiency sealing in minimum packing depth. Each ring provides an efficient, individual seal—nests with adjacent rings in an interlocking manner without compression adjustment for true, multiple-ring action.

With Uneepac, you can achieve high-efficiency sealing with fewer rings, smaller stuffing boxes. For quick, easy installation, Uneepac rings are self-centering, self-adjusting. Make it a point to consider Uneepac Rings for every application requiring top packing efficiency and life.

Uneepac rings are available in all standard materials in a wide range of sizes for most rod and plunger applications. For further information, write to Johns-Manville, Box 14, New York 16, N. Y.

J-M Clipper Seals—used as rod wipers in BE-GE cylinders—keep dirt out.

JOHNS-MANVILLE

JOHNS-MANVILLE PRODUCTS

a design engineer recently paid us this compliment while examining one of our cylinders. We pass it on to you with the idea that you too may find Pathon cylinders designed right for the job on your cylinder applications.

"It's designed right—just the way I'd do it myself."

As a designer...

YOU GET EVERYTHING YOU WANT IN A HYDRAULIC CYLINDER

Pathon

HYDRAULIC CYLINDERS

are made in eight standard models and can be adapted to practically any application. Write us today for Bulletin No. 22. We're glad to help you on any cylinder problem.

- **COMPACTNESS**
- **LOW STRESS CONCENTRATION**
- **INCREASED STRENGTH ... AND FATIGUE LIFE**

All Pathon Hydraulic Cylinders in Series RH 2000 P.S.I. and QH 1000 P.S.I. use a single screw head to attach the head to the body of the cylinder. This design provides an absolute minimum of physical size and at the same time reduces stress concentration throughout the barrel to the head attaching area. You get a *plus factor* in shock loading with increased strength and fatigue life. Your Pathon Hydraulic Cylinders are simple and sturdy in construction, require much less maintenance.

Pathon AIR CYLINDERS

DIRECTIONAL CONTROL VALVES

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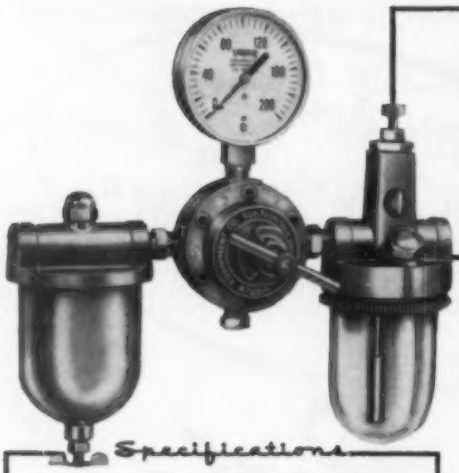

PNEUMATIC CONTROLS BY VICTOR

FOR AIR-OPERATED TOOLS AND MACHINERY

FILTER Reliable operation of air equipment is dependent on removal of dirt, pipe scale and condensation from the air supply.

1. **A Porous Sintered Bronze** element provides maximum impurity trapping action with minimum air flow resistance (approximately 3 p.s.i. per 10 c.f.m.).
2. **Inlet Designed** to deflect the incoming air in a downward spiral motion to trap condensation and impurities which are removed through the petcock at the bottom of the bowl.
3. **Readily Disassembled** for complete cleaning by the removal of the top body nut.
4. **Available With Steel or Plastic Bowl.** Metal bowl is recommended for installations involving rough usage. The tough, durable plastic bowl is desirable because it provides full view of filtering action, showing condition of the air line and when to drain filter.

REGULATOR The VICTOR A-250 and A-375 Air Regulators are for reducing supply line pressures to required operating pressures and maintaining a constant pressure and flow of air to cylinders, pneumatic tools, and other types of air equipment.

1. **Self-Relieving Feature** protects equipment from over-pressure and permits relieving of delivery pressure by backing off the adjusting screw.
2. **Minimum Pressure Drop** is provided by a siphon port in the low pressure chamber which increases diaphragm response to delivery pressure demands.
3. **Freedom From Chatter** is made possible by a new design using a special "O" ring guide in the seat holder which effectively dampens out vibration under flow conditions.
4. **Simple, Sturdy Housing** of quality treated aluminum provides full strength and service without unnecessary weight. Internal parts are designed for simplicity and long life. Regulators laboratory tested millions of cycles, to insure trouble free operation under working conditions.
5. **Maximum Trouble-Free Diaphragm Life** is assured by the use of highest quality neoprene that will not separate or rupture.
6. **Trouble-Free Seat Life and Full Air Flow** is assured by an exclusive seat and nozzle design utilizing a precision molded half round neoprene seat against a flat face nozzle.
7. **Valve Seat Assembly Readily Accessible** for inspection by removing back plug.
8. **Sturdy Adjusting Screw** with smooth rolled threads, operates through a steel insert bushing. A lock-nut is provided for holding pressure settings. Adjusting screw can also be wire sealed through convenient tabs on bonnet to conform to JIC pneumatic standards.

LUBRICATOR The VICTOR Lubricator provides a dependable and accurate source of wear-protecting lubrication for all types of air equipment such as chucks, screw drivers, grinders, hoists, chipping hammers, air cylinders, etc.

1. **Visual Setting** of the lubrication rate results in correct oiling without guessing. The precision needle valve provides a wide range of accurate and consistent oil flow to the air line under operating conditions.
2. **Reliable Lubrication Rate.** The VICTOR Lubricator is designed to eliminate air locking and over feeding of oil into the line when the air flow stops or fluctuates. A filter in the oil feed line insures a constant flow of clean oil to the metering valve at all times.
3. **The Visual Oil Supply Cup** is made of a durable and tough plastic with a safety factor of 5 times the recommended maximum working pressure of 125 p.s.i. It has a 1/3 pint capacity.
4. **Oil Cup Easy to Fill.** Refilling can readily be accomplished through the filler plug without shutting off the air supply. The oil cup can be removed for cleaning or filling without shutting down the air supply, if the filler plug is removed before loosening the cup retaining nut.

Specifications

MODEL COMBINATIONS

	MODEL	WEIGHT
FRL	FRL-250	5 lb. 14 oz.
	FRL-375	5 lb. 14 oz.
	FRL-250P	5 lb. 14 oz.
	FRL-375P	5 lb. 14 oz.
FL	FL-250	3 lb.
	FL-375	3 lb.
	FL-250P	3 lb.
	FL-375P	3 lb.
F	F-250	1 lb. 7 oz.
	F-375	1 lb. 7 oz.
	F-250P	1 lb. 7 oz.
	F-375P	1 lb. 7 oz.
FR	FR-250	4 lb. 5 oz.
	FR-375	4 lb. 5 oz.
	FR-250P	4 lb. 5 oz.
	FR-375P	4 lb. 5 oz.
R	A-250	2 lb. 14 oz.
	A-375	2 lb. 14 oz.
RL	RL-250	4 lb. 7 oz.
	RL-375	4 lb. 7 oz.
L	L-250	1 lb. 9 oz.
	L-375	1 lb. 9 oz.

All 250 Models have ¼"-18 NPT(F) Inlet and Outlet Connections.

All 375 Models have ⅜"-18 NPT(F) Inlet and Outlet Connections.

NOTE:
All Filters, Regulators, and Lubricators listed have left hand inlets. If right hand inlet is desired, place "R" after the model number.

No. 44

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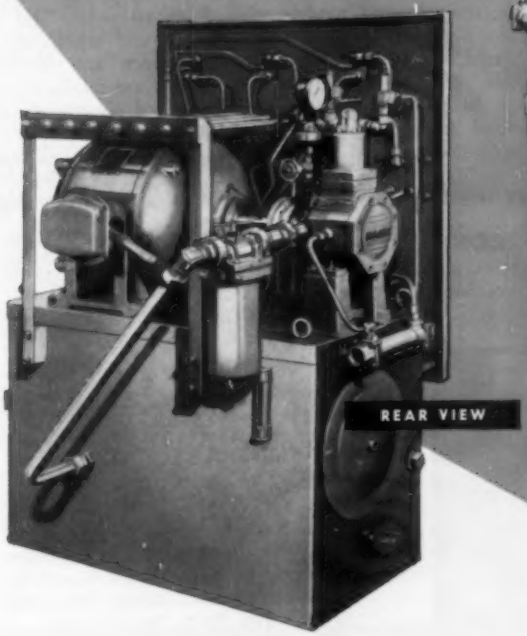
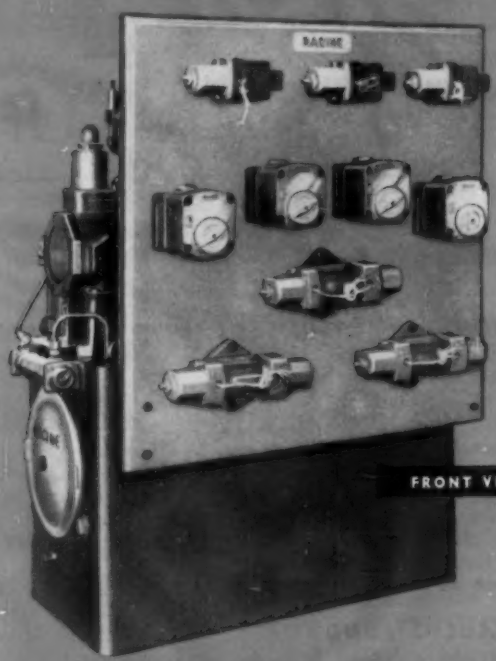


REAR VIEW



FRONT VIEW

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Investigate RACINE'S *free* engineering service. Let Racine Hydraulic specialists relieve your engineering load. It will save you valuable time and money. Utilize this responsible single source of supply. Write us about your hydraulic projects. Your needs will receive prompt attention. No obligation.

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USEFUL LITERATURE

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CUSHIONED AIR CYLINDERS . . . 150 psi heavy duty type with adjustable cushions at both ends are covered in bulletin No. 258 from *The Sheffer Corp., Cincinnati, Ohio.* Bulletin lists all mounting dimensions on cylinders with bore sizes 1½ to 6 in and strokes to 24 in. Piston rods are hard chrome plated and have milled wrench flats.
CIRCLE 400 ON READER SERVICE CARD

HYDRAULIC FUNDAMENTALS... and industrial hydraulic oils are described and illustrated in a 44-page book available from *Sun Oil Co., Philadelphia, Pa.* The book is a practical introduction to the principles of hydraulic systems with illustrations on valves, pumps, motors, torque converters, and accessories.
CIRCLE 401 ON READER SERVICE CARD

STEEL TUBING DATA . . . are contained in a new 12 page catalog available from *Brainard Steel Tubing Div., Sharon Steel Corp., Warren, Ohio.* Bulk of the book is devoted to tables showing size range, cutting and size tolerances of round tubing; size ranges, radii of corners and tolerances of square and rectangular tubing. Information valuable to design engineers and other purchasers of welding tubing.
CIRCLE 402 ON READER SERVICE CARD

TRIPLEX PUMPS... for pressures to 20,000 psi are described in a 12-page illustrated bulletin issued by *Kobe, Inc., Huntington Park, Calif.* The booklet includes all of the necessary engineering information on the two available sizes. The pumps will withstand temperatures of 500 F and have capacities up to 58 gpm. They are available with integral motor drive or with shaft for separate drive.
CIRCLE 403 ON READER SERVICE CARD

SERVO CONTROLLED . . . hydraulic open-loop electro-feedback systems are covered in a fluid power news report prepared by *The Oilgear Co., Milwaukee, Wis.* The report was presented before the NCIH in Chicago, and indicates the accuracies and flexibilities of a system of this type.
CIRCLE 404 ON READER SERVICE CARD

AUTOMATION CONTROLS . . . including counters, switches, valves, actuators, relays, limit controls, and time switches are described in a new catalog released by *General Controls Co., Glendale, Calif.* The new catalog groups together under one cover the wide selection of controls made by the company.

CIRCLE 405 ON READER SERVICE CARD

U-CUP PACKINGS . . . of molded synthetic rubber having flared side walls to create interference fit are covered in bulletin AD-163 published by *The Garlock Packing Co., Palmyra, N. Y.* The bulletin describes uses, pressures, construction, and available sizes.
CIRCLE 406 ON READER SERVICE CARD

LATCH RELAYS . . . which need no extra vertical height are illustrated in a 4-page bulletin 7305-PML prepared by *The Clark Controller Co., Cleveland, Ohio.* Included are pictures of 9 standard models with 2 to 10 poles. The number of circuits and combinations of normally-open and normally-closed contacts are tabulated, and there is a table of dimensions.
CIRCLE 407 ON READER SERVICE CARD

HYDRAULIC PUMPS . . . valves, motors, and cylinders are detailed in a catalog available from *Mechanisms Co., Ubrichsville, Ohio.* The equipment covered is designed primarily for materials handling applications. Data on a unique hydraulically powered wheel shows a new approach to hydrostatic drives for mobile equipment.
CIRCLE 408 ON READER SERVICE CARD

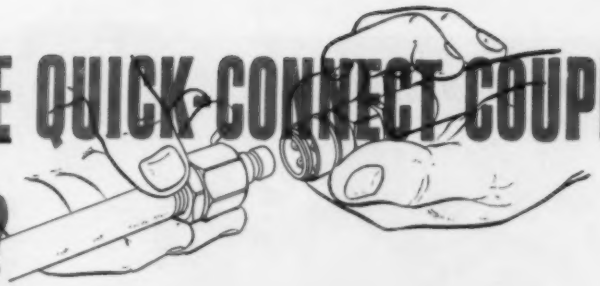
PNEUMATIC CONTROLS . . . positioners and accessory components are illustrated and described in bulletin DO-00-2 of *Westinghouse Air Brake Co., Wilmerding, Pa.* Bulletin is useful as an index to the numerous catalogs that may be obtained from the company.
CIRCLE 409 ON READER SERVICE CARD

BY-PASS FLOW REGULATOR . . . with built-in relief valve that can be used to replace a pump for power steering is described in catalog sheet 3.43 issued by *Fluid Controls, Inc., Mentor, Ohio.* Sheet includes pressure specifications, porting arrangements, and dimensions.
CIRCLE 410 ON READER SERVICE CARD

HIGH PRESSURE HOSE AND FITTINGS . . . are described in catalog 4430 published by Parker Hose and Fittings Div., *Parker-Hannifin Corp., Cleveland, Ohio.* Included are double wire braid hose and reusable Hoze-lok fittings, stainless steel braided hose, and perforated cover hose. Hose assemblies are also cataloged with instructions on making them up.
CIRCLE 411 ON READER SERVICE CARD

For more reviews of FREE LITERATURE turn to page 144

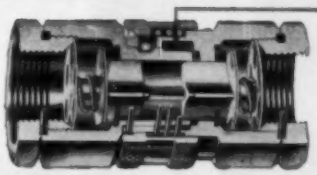
WHICH SNAP-TITE QUICK-CONNECT COUPLING IS BEST FOR YOU?



SNAP-TITE "H" COUPLING . . . . . FOR HIGH PRESSURE APPLICATIONS

FOR HYDRAULIC OR AIR

"H" Coupling for high strength, higher efficiency, high-resistance to heavy line surge. Sizes: ⅛" thru 12". Bulletin No. 240

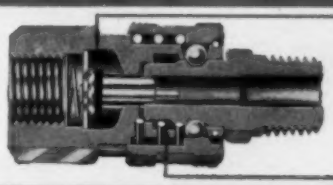


Exclusive U-packer gives a positive seal without compression set because of rubber distortion. Line pressure inside the U-packer keeps it open and forced against its metal backing—the higher the pressure, the tighter the seal.

SNAP-TITE HI-FLOW COUPLING . . . FOR LOW PRESSURE APPLICATIONS

FOR AIR AND FLUIDS UP TO 150 p.s.i.

Hi-Flow is recommended to connect small air tools to plant air system, and for low pressure fluid transfer in small lines. Sizes: ⅛" thru ¾". Bulletin No. 230

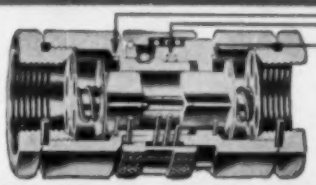


Bonded valve washer
(pat. pending on valve construction)

Exclusive U-packer

SNAP-TITE "TH" COUPLING . . . . . FOR HARD TO HANDLE FLUIDS

FOR FUMING ACIDS, ALKALIES, SOLVENTS, AND HIGH PRESSURE STEAM . . . "TH" is the only coupling now on the market for fluid temperatures from —100° F to +500° F . . . and for live steam up to 460° F. Its seals are made of Teflon for which there is no known solvent. Sizes: ½" thru 3". Bulletin No. 270



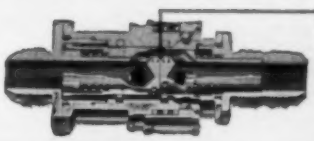
Teflon Valve Seal

Teflon Nipple Seal

Teflon Valve Seal

SNAP-TITE NO-SPILL COUPLING . . . FOR MINIMUM AIR INCLUSION

FOR AIRCRAFT, MISSILE HYDRAULIC, FUEL SYSTEMS which cannot stand air in the lines, and for transmitting fluids which *must not spill*, the Snap-Tite no-spill coupling is recommended. Bulletin No. 280



Flush valves prevent spillage, air inclusion. Snap-Tite will engineer special variations to your requirements.

SNAP-TITE "E" COUPLING . . . . . FOR VACUUM and VERY LOW PRESSURE

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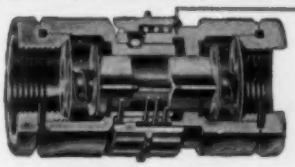


Nipple seals in coupler by depressing the lip of the E packer and slightly compressing the body of the packer. This new E-packer gives positive seal under high-pressure, low-pressure, and vacuum.

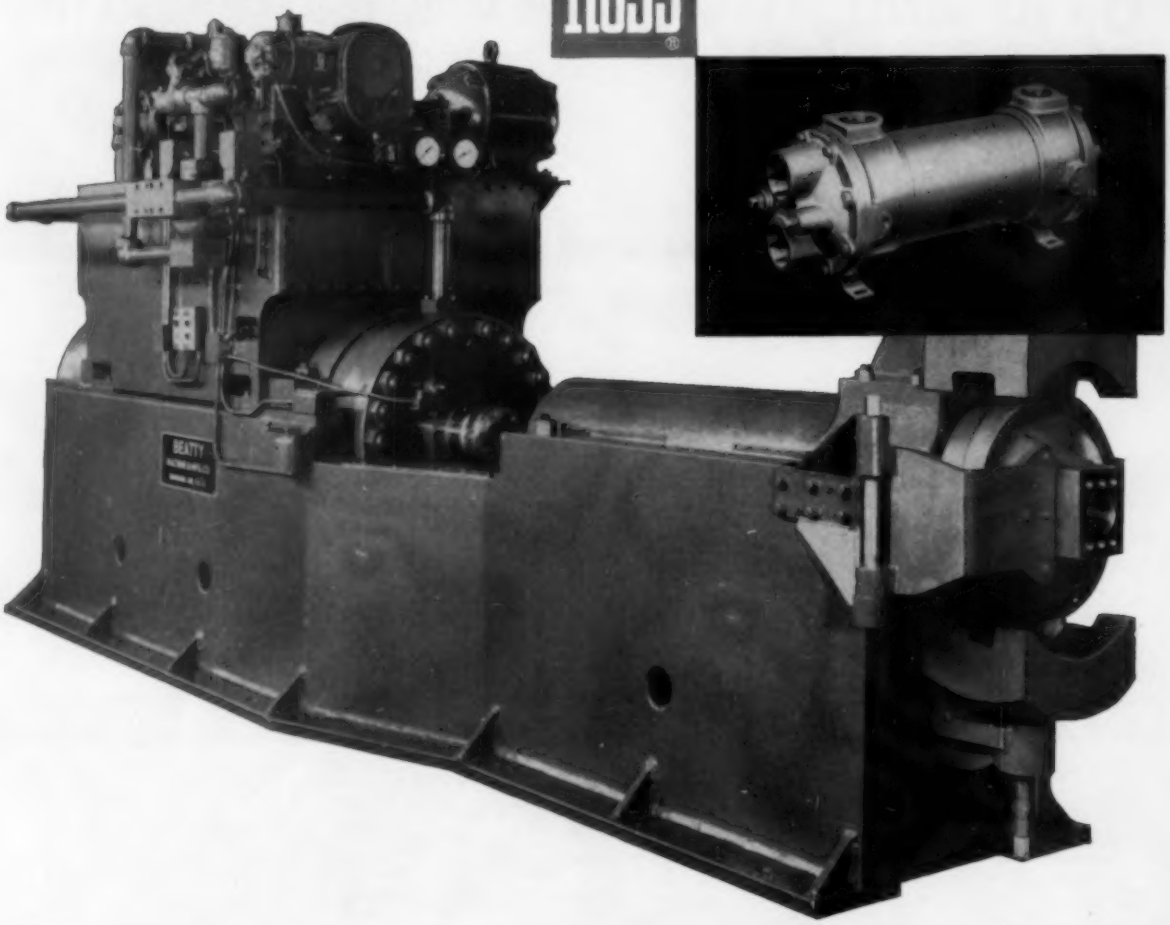
Snap-Tite Couplings are available plain, (without valves), and with either single or double shut-off. Couplings normally furnished in alloy steel, but all (except hi-flow) are also available in brass, aluminum, or stainless steel with a variety of finishes.

SNAP-TITE, INC., UNION CITY 1, PA.

Snap-Tite

SNAP-TITE COUPLINGS CAN HANDLE ALMOST ANYTHING THAT FLOWS

COOLING BY ROSS



Oil temperature protected during high pressure, low speed operations

Oil doesn't get a chance to overheat, thin out and cause pump slippage in this 325-Ton Beatty Hydraulic Extrusion Press. A Ross Type BCF Exchanger keeps fluid temperatures within prescribed limits.

"On practically all of our hydraulic presses, we furnish Ross Coolers", states Beatty Machine & Manufacturing Co., "because very often this equipment will be operating at high pressure and low volume for long periods of time."

The same features that make Ross the choice for Beatty hydraulic presses, make them the choice for hydraulic machinery of other makes and types. Design engineers like their . . .

Ruggedness – to withstand punishing hydraulic surges. **Compactness** – for easy installation. **High Thermal Efficiency** – for safe and effective fluid temperatures. **Standardization** – a large selection of pre-engineered, fully standard designs to meet most requirements.

If you have a hand in hydraulic equipment where heat control is a factor, it will pay you to learn more facts about Ross Type BCF Exchangers. Recently redesigned, they feature new flanged-lip baffles for tighter tube fit and improved thermal characteristics, *new* movable feet to simplify mounting, *new* materials, *new* sizes and capacities in one, two and four pass arrangements.

For complete details, request new Bulletin 1.1K6. American-Standard*, Ross Heat Exchanger Division, Buffalo 5, N. Y. In Canada: American-Standard Products (Canada) Limited, Station D, Toronto, Ont.

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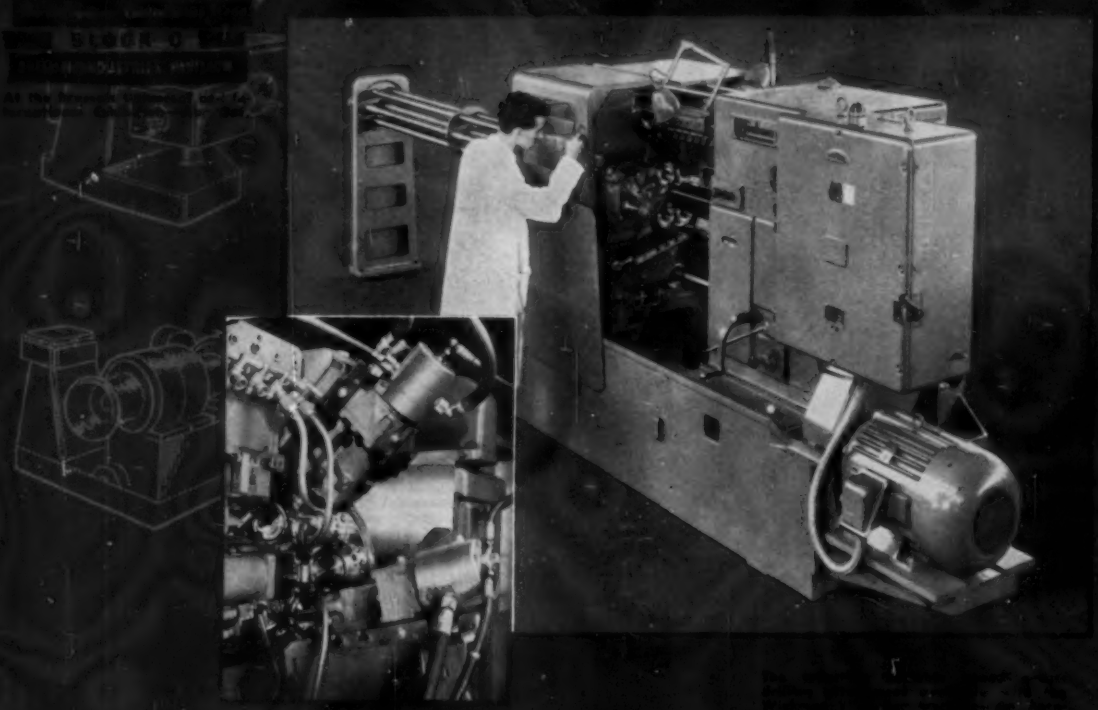
AMERICAN-Standard

ROSS HEAT EXCHANGER DIVISION

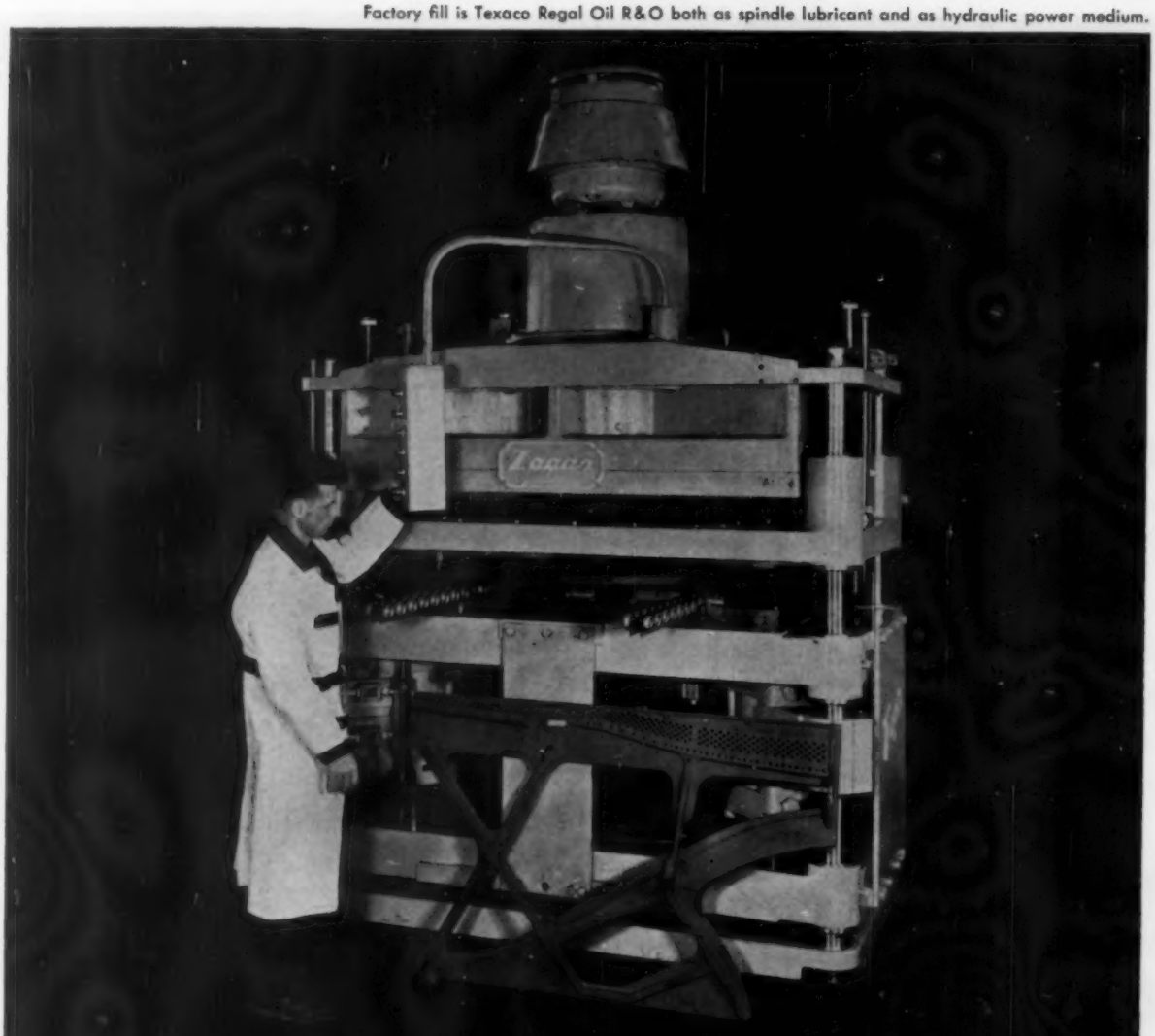
Keelavite HYDRAULICS



THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

CIRCLE 64 ON READER SERVICE CARD

Factory fill is Texaco Regal Oil R&O both as spindle lubricant and as hydraulic power medium.



HOW TO DRILL A CAST IRON HARP IN ONE SHOT

This machine drills 417 holes (from $^{3}/_{32}$" to $^{7}/_{16}$") all in a single bite, the action being controlled by a powerful hydraulic system.

To keep the intricate valve and line system clean, to lubricate the spindles and assure their accurate functioning, the manufacturer specifies use of Texaco Regal Oil R&O. It has much greater oxidation resistance than regular machine oils. It prevents rust and foam. It keeps the machine's action smooth and effective. And, from the economy standpoint, it has a far longer service life.

Whatever your hydraulic equipment—from giant press to delicate control—there is a Texaco Regal Oil R&O exactly suited for the job. Call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, New York.

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

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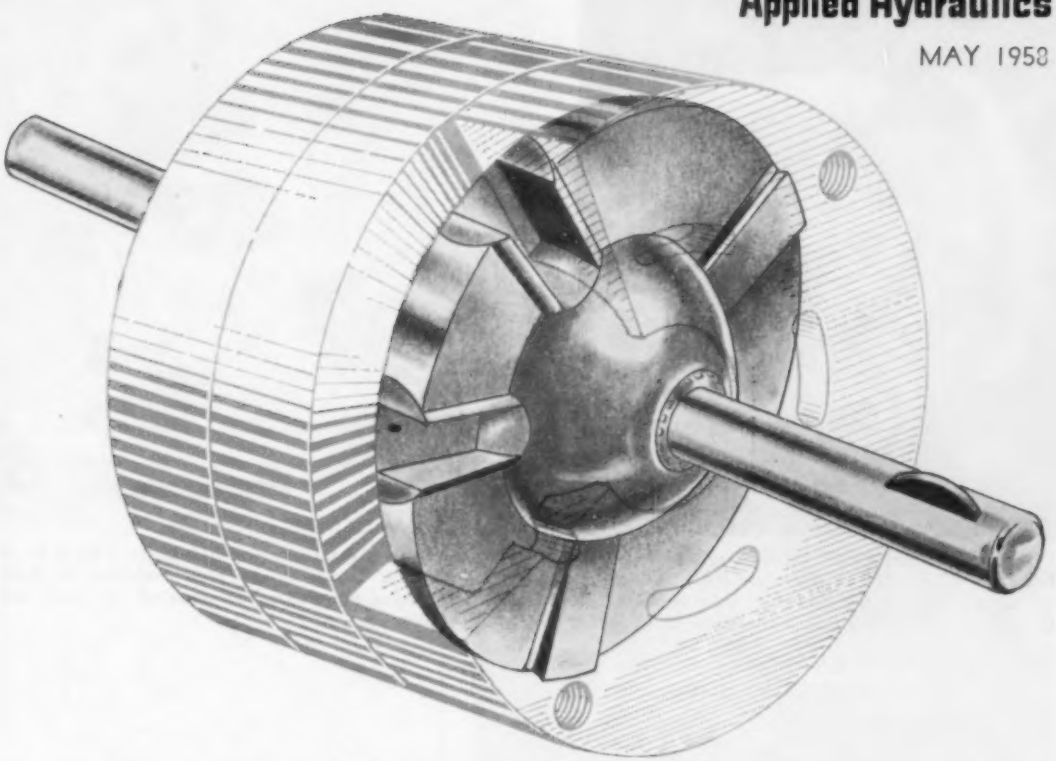


New pump design promises low weight per horsepower

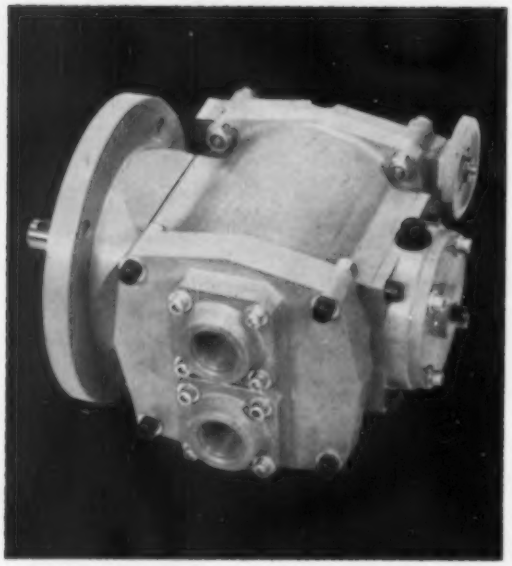
• By John W. Houser, *Program Engineer, U. S. Naval Air Development Center, Johnsville, Pa.*

A brand new pump design is a rarity. Here's one that seems to have real potential. The author of this article, and inventor of the pump, freely admits that actual in-service testing of the design has not been so extensive as to make everything said here 100% certain. However, several have been built and tested and lived up to expectations. A last minute report from him was that tests have confirmed that the unit works just as well as a motor.

UNIQUE in its design, a new pump, Figure 1, being developed at the Naval Air Development Center in Johnsville, promises increased flow and power per unit of weight and volume over that available from other pumps. Although, shape of the pumping elements is unconventional and perhaps not well described by terms like piston and cylinder, high flow, low weight and small size of the pump are the result of double-acting piston and cylinder construction.

• **How It Works**—Pumping or rotating elements are: a central disc, or rotor, with 5 segments extending from the spherical hub; two side plates with chambers to match the segments on the rotor; and a separating ring to space the side plates on either side of the rotor, Figure 2. Spaces between the rotor segments are filled by slotted pins and rectangular blocks. The blocks match up with the portions of the side plates between the chambers to make continuous seals between all the chambers, when the unit is assembled, Figure 3.

The pumping elements, or rotating group, rotate within a tiltable box made up of a central member and two valve plates,



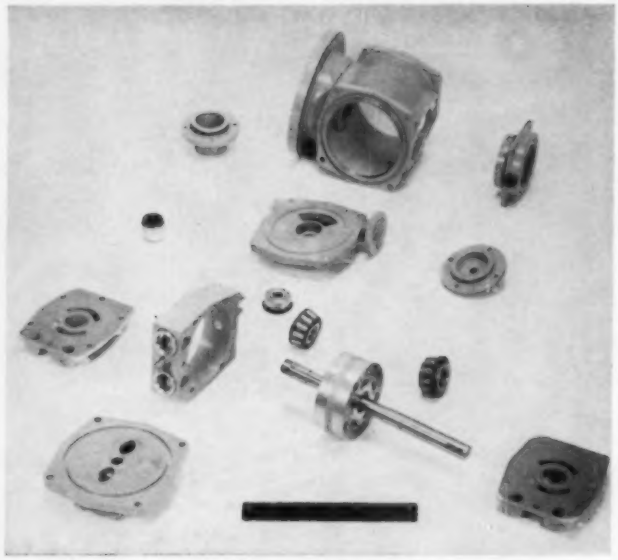


FIG. 1. DEVELOPMENT MODEL of the pump described in this article measures approximately 6 by 6 by 6 in., weighs 15.6 lb and is designed for 3000-psi, 6000-rpm operation. Displacement per revolution is 1.50 cu in. Horsepower per pound at maximum conditions is 4.3. By using aluminum for some of the steel and bronze parts, weight could be reduced to 10 lb for short life applications.

Figure 1 and 4. The housing containing the rotating elements is assembled into a case which incorporates tilt control, external ports, shaft bearings and seals.

As shown in Figure 4, when the housing is tilted and the rotor revolved, the position of the pumping chamber shifts from side to side with respect to the rotor segment since the rotor is always held in one plane. When relative motion of the side plate and rotor segment is such that the segment is moving away from the side plate, oil is drawn into the pumping chamber. Then, when the side plate moves toward the rotor segment, oil is forced out of the chamber through the hole in the side plate into a passage in the valve plate.

While a rotor segment is drawing oil into one side of the pumping chamber, it is also forcing oil out the other side of the same chamber. Thus, each pumping chamber is filled and emptied twice during each revolution of the rotor, once on each side of a segment. This is what accounts for the high output of the pump. For the same reason, output flow characteristic is that of a ten-cylinder pump.

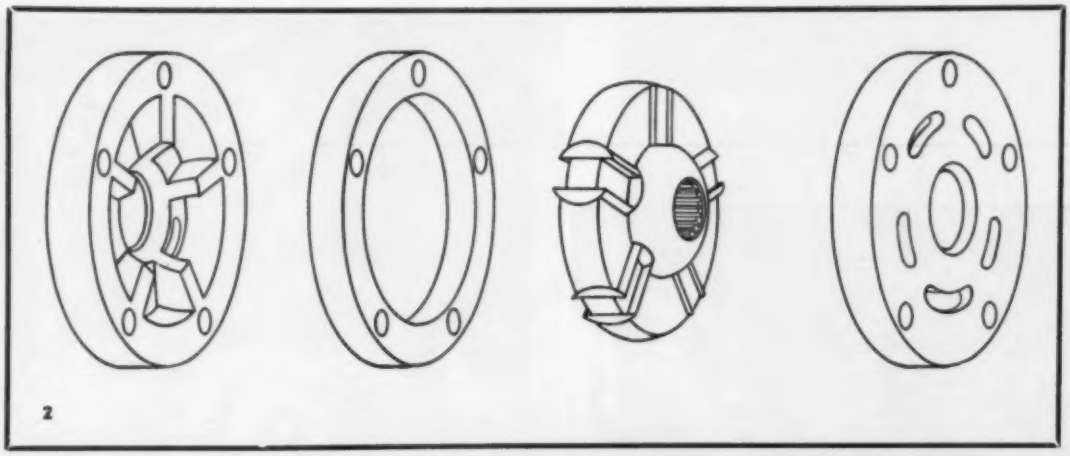
Figure 4 shows the tilting parts hard over to one side which would give maximum displacement. Tilt may be varied to reduce flow to zero or to give maximum flow in the other direction. Maximum tilt to either side of center is 15 deg.

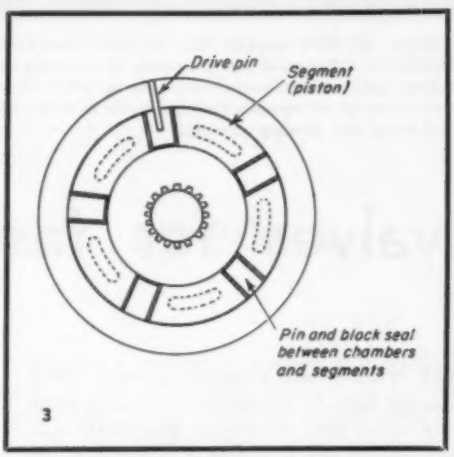
• **Balance**—Because chambers on both sides of the rotor are discharging at the same time, the pump is hydraulically balanced axially. Since the chambers discharging at the same time are diametrically opposite, there is a force couple which tends to tilt the rotor in the same direction the housing is tilted. The wide span between the shaft bearings reduces the bearing loading because of this couple force.

There is no off-center weight in the design. The pump is, therefore, inherently mass balanced. The only radial loads on the bearings, in addition to the couple, are due to the weight of the shaft and rotor, and driving torque. High speed rotation is a definite capability of the design.

• **Production**—Many of the parts of this pump have spherical surfaces. Accuracy and high precision of these parts is necessary to get high volumetric and mechanical efficiencies. Production machines developed at the same time as the pump will make these parts with an error of only 10 to 20 millionths of an inch on the diameter as measured with a light wave microscope. Finishes on the spherical surfaces are from 2 to 4 microinches RMS. Cost of manufacturing the pump should be no more than that of other high-precision pumps.

• **Other Features**—Since all rubbing velocities in the pump are low except those between the rotor and the valve plates, wear rates should be low. Valve plate and mating rotor face wear are comparable to the wear of similar parts in other pump designs, due to the hydraulically balanced rotor.





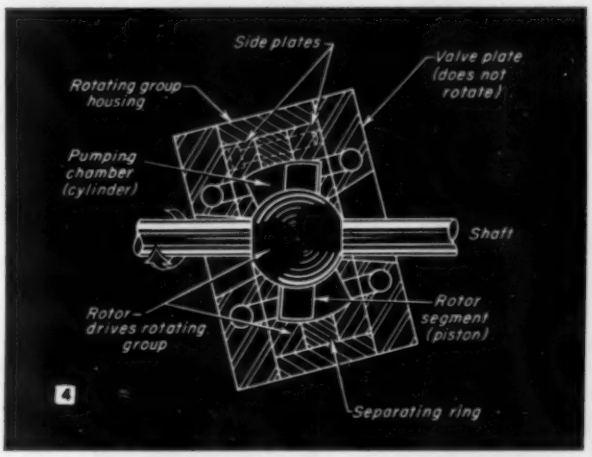


FIG. 2. EXPLODED VIEW of the rotor parts. FIG. 3. PUMPING CHAMBERS are separated and sealed by slotted pins and rectangular blocks fitted into the rotor as well as by parts of the side plates. FIG. 4. SECTION THROUGH the rotor and tiltable box which contains the rotor elements. This shows how tilting side plates and separating ring with respect to the rotor causes side-to-side motion of the pumping chambers while rotor segments stay in one plane.

Complete reconditioning of the high velocity pumping parts can be done easily. All that is needed is to lap valve plates and rotor faces and then restore original clearances by lapping the correct amount off one face of the center spacer.

One of the original design objectives was to make a pump which could be used with a variety of liquids of questionable lubricating value. Obviously, it will be easy to seal shaft and tilting housing bearings from the liquid being pumped and use something else for lubrication of these bearings. ▼▼▼

Previous articles on pump design, performance, and construction that will allow some interesting comparisons are:

"Hydraulic Pump Selection," APPLIED HYDRAULICS, April, 1958.

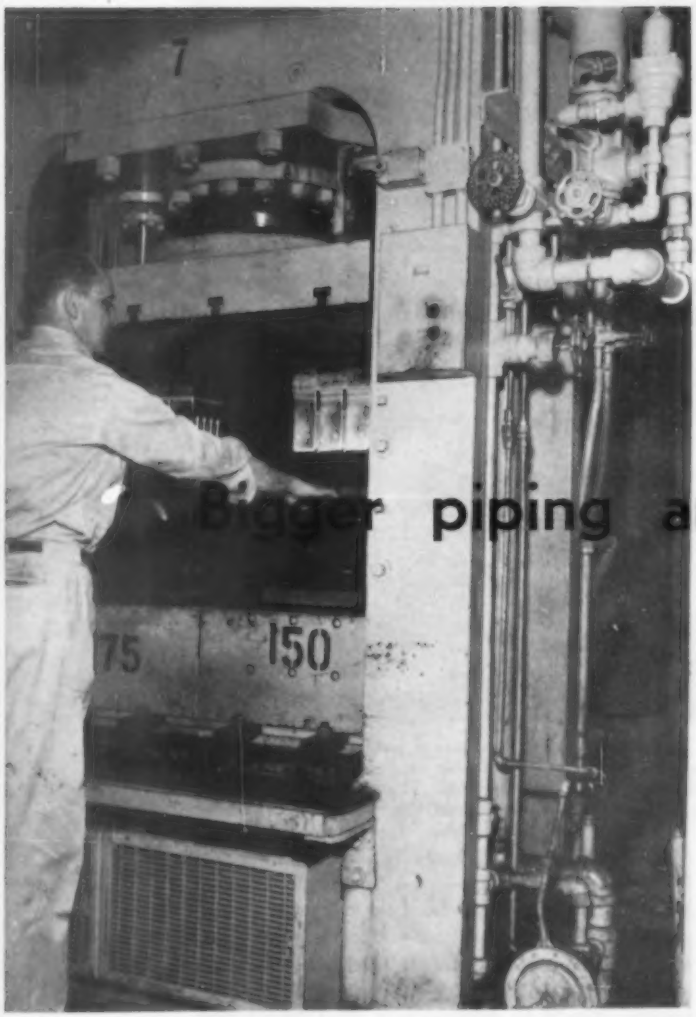
"Aircraft Hydraulic Pumps," APPLIED HYDRAULICS, April, 1958.

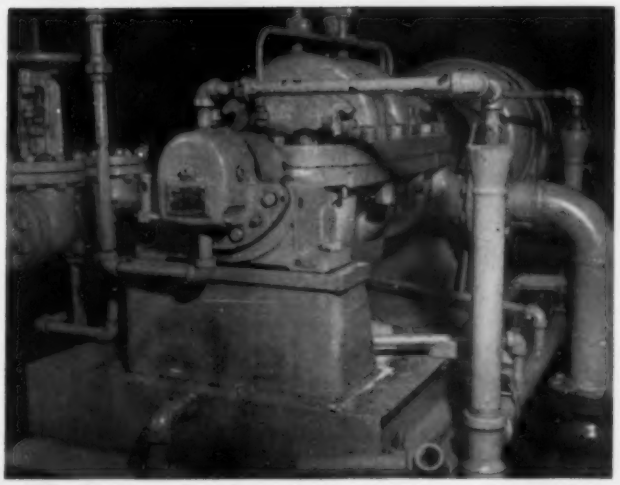
"High-Speed Pump and Motor Design," by R. H. Marvin, APPLIED HYDRAULICS, July, 1955.

"Trends in British Aircraft Pumps," by J. A. Lankester, APPLIED HYDRAULICS, Aug., 1954.

"An Electro-Hydraulic Servo Pump," by N. Williams, APPLIED HYDRAULICS, March, 1954.

"Pump Design Gives Controlled Delivery With Variable Input Speed," APPLIED HYDRAULICS, April, 1953.





CENTRIFUGAL PUMPS supply the low pressure system. Because delivery is a function of pressure, decreasing line drop and installing an accumulator results in greater flow to the presses and faster press speeds. Low pressure system supplies 80 to 85% of fluid for closing presses.

Bigger piping and valves for faster

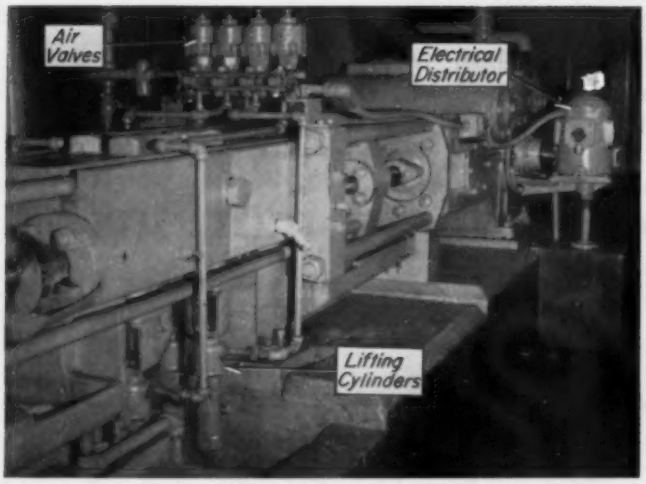
• By Robert S. Paulson,
Manager of Engineering
and Clayton C. Verlo,
Senior Operations Engineer
The Richardson Co., Melrose Park, Illinois

CENTRAL systems have a way of growing like a 14 year-old boy. As production increases, more presses are added until the system sprawls through the factory like the 800 ft of pipe at Richardson. Of course line drop increases along with each inch of pipe that's added. Even more important, pressure drop through the valves increases because of the larger flows.

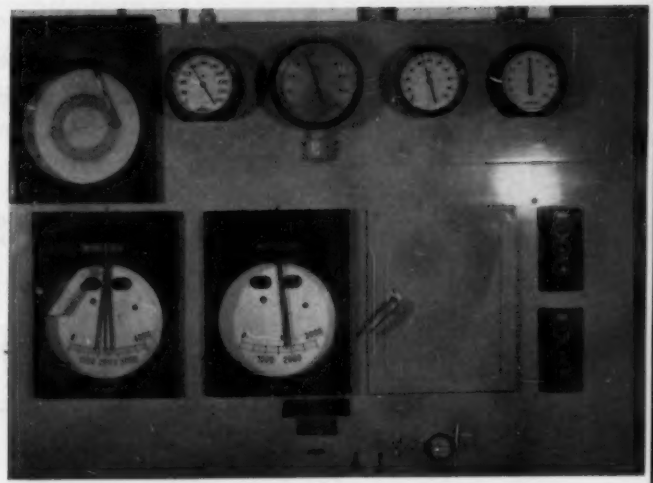
Since the low pressure system which supplied 80 to 85% of the fluid for closing the presses was supplied by centrifugal pumps, this pressure drop results in decreased press speeds. The presses require about 250 psi for closing. Back at the pumps, the pressure is 500 psi. Rated capacities of the four centrifugal pumps supplying the system at 500 psi are one 200-gpm, two 375-gpm, and one 500-gpm. These are connected to the system according to the number of presses that are operating.

• **Pipe to tube**—The answer to higher production without adding presses was bigger piping and valves. Together with the addition of a 160-gal accumulator for the low pressure system, this increased press speeds from 100 ipm to about 400 ipm. On some presses, the number of shots per hour increased from 12 to 18. Rams range from 12 to 32 inches on the plastic molding and laminate presses.

Pipe size was increased by going from 2-inch double extra heavy pipe to 2-inch Schedule 160



HORIZONTAL DUPLEX PUMPS supply the high pressure system. Solenoid-operated air valves are part of the synchronized unloading system which loads and unloads the pump smoothly over a complete cycle. Electrical distributor which actuates solenoid valves is driven at pump speed and is energized by accumulator controls.



CONTROL PANEL for the central hydraulic system includes indicating gauges for the high pressure system and recording instrument. Large dials in lower row are pressure controllers for pump unloading and protective devices.

press speeds

tube. This increased line area from 1.774 to 2.241 sq. in. without loss in strength. Valves were re-sized from 1¼ and 1½-inch to 1½ and 2-inch port sizes.

The low pressure accumulator was designed for 550-psi average pressure, so that pump pressure now varies from 400 to 625 psi. Sizing this accumulator required finding out how many presses operate at once and then calculating the maximum flow requirements. The accumulator supplies the short-time, high flow requirements.

The high pressure system for the plant is operated at 2000 psi and is supplied by horizontal, double-acting-duplex pumps. Synchronized unloading on the pumps gives smooth loading and unloading of the pump over one complete cycle. Synchronous motors driving the pumps improve power factor in the plant. These have a better power factor than induction motors, especially under no-load conditions. The high pressure pumps deliver water to the system about half the time.

• **Reduced shock**—Weighted accumulators were replaced by air-ballasted types some years ago. High shock loads and frequent packing maintenance were eliminated. The 50 gpm high pressure accumulators are 26-ft high and 28 inches in diameter.

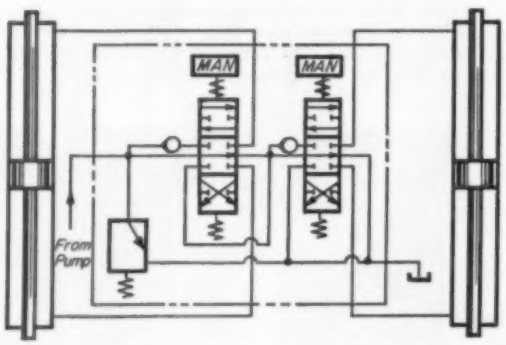
Soluble oil is added to the system regularly by mixing it into collecting sumps installed between the presses and reservoir. These sumps reduce back pressure which would be appreciable if all return lines were brought directly back to the main reservoir. Weekly checks are made to insure a 3 to 5% soluble oil in the water. Coarse screens are used for filters. ▼▼▼

HIGH PRESSURE ACCUMULATOR has normally-closed diaphragm-operated valve at outlet for safety shut-off to prevent loss of air into the system. Valve is held open by solenoid-operated air valve energized by float switch control which also regulates normal low and high water levels and high level alarm. Laminated construction accumulator has a working capacity of 50 gal.

What's the best way to synchronize two hydraulically powered motions? It depends on the relative importance of several factors: the degree of required accuracy, the maximum difference in loading, and whether one of the motions meets solid resistance before the other.

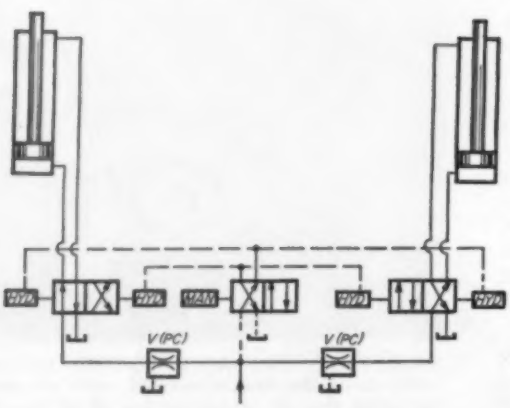
Four ways to synchronize motions

• By Ed Gatwood, *Vickers, Inc., Detroit, Michigan*



In this circuit, manual control valves direct discharge from one cylinder or hydraulic motor into the other. Except for leakage, cylinder speeds will be equal if their displacements are equal. Cylinder leakage and *slip* vary with loads and the heavier loaded cylinder will be the slower.

Both motions will stop when one cylinder or the other meets solid resistance. Either may be powered individually by shifting its control valve from neutral with the other remaining centered. Shifting the two control valves in opposite directions from neutral causes synchronized motion in opposite directions. When operating together, total thrust or torque, determined by cylinder size and pressure, is divided between cylinders in proportion to load distribution. Usually non-differential cylinders are used. Differential cylinders can be used, but this involves some mechanical difficulty and saves no space.

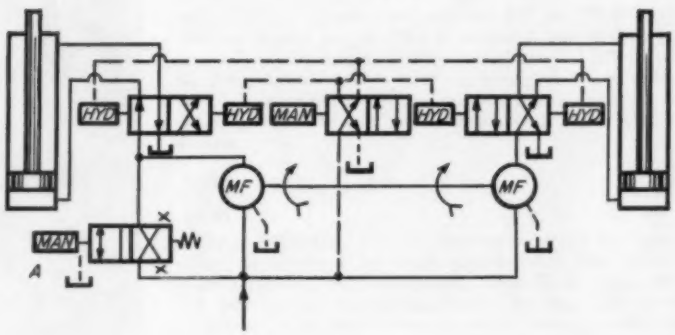


Two flow control valves divide the flow. This is not recommended for precise synchronization because it is nearly impossible to adjust the valves so they pass exactly equal flows. Some degree of erratic performance may also be expected, because the pressure compensating devices affect each other when used in parallel.

Since combined flow passed by the two valves must be less than pump delivery, excess flow must pass over the system relief valve. Therefore power input to the system is determined by pump delivery and relief valve setting and remains constant regardless of changes in work loads.

One advantage of this circuit for certain applications is that each actuator completes its motion even though one meets solid resistance before the other.

Two rotary fluid motors of like size are coupled together to act as a flow divider. Principal factors which affect the degree of synchronization are variation in motor displacement because of manufacturing tolerances, and variation in leakage and slippage because of difference in loading. These factors will probably cause one actuator to reach the end of its motion before the other.



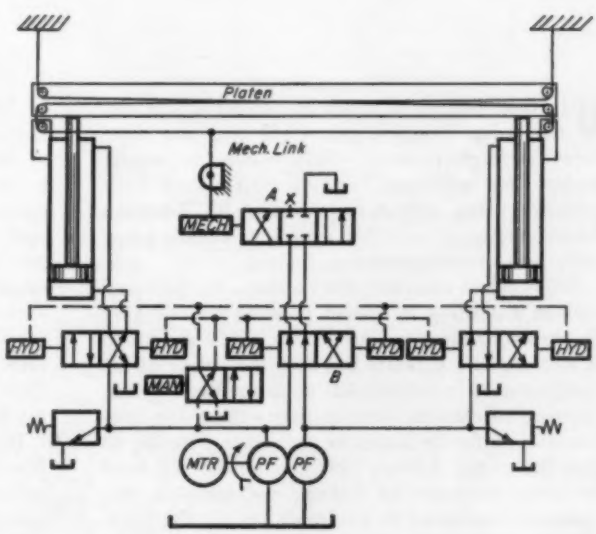
Both actuators stop when either meets solid resistance. Therefore, it is necessary to use a bypass valve which either bypasses one of the fluid motors or permits it to freewheel to let both cylinders complete their motions. When only one cylinder is moving, its speed may approach twice normal unless flow through the bypass valve is restricted.

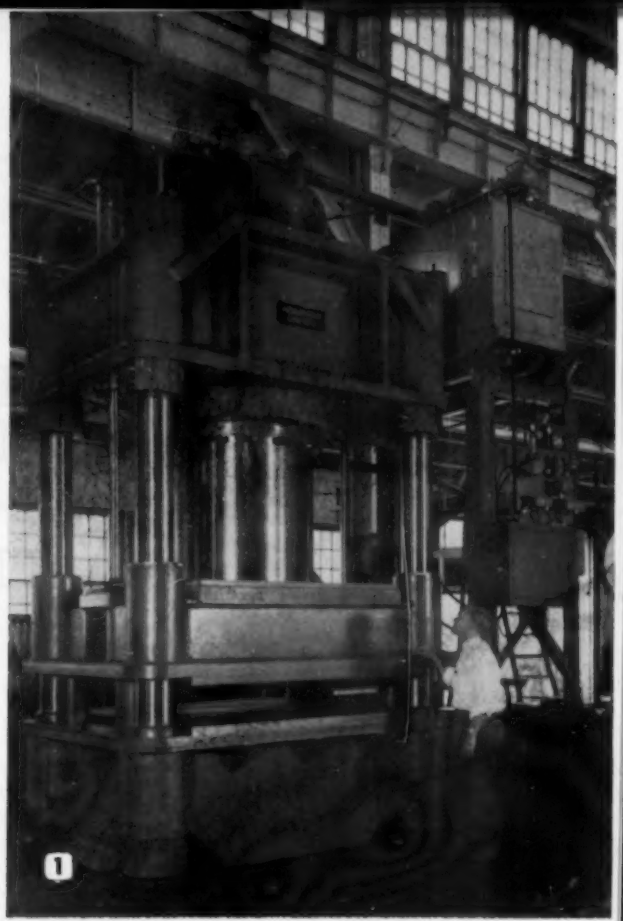
With the bypass valve closed, pressure in one cylinder may approach twice the setting of the system relief valve if the cylinder meets solid resistance with the other still moving freely. This is caused by one of the flow dividing motors driving the other as a pump. Assuming very light load on the second cylinder, the outlet pressure of the flow dividing motor on this side will be very low. Therefore, since pressure at its inlet is equal to relief valve setting, almost the full torque of this motor helps to drive the other as a pump. With relief pressure at the inlet of the first motor, pressure at its outlet approaches twice this value. This feature should be evaluated carefully for each application to determine if it is an advantage or disadvantage.

A device can provide a signal which makes automatic and continuous corrections for any tendency to misalignment. The device can take many forms and may be mechanical, electric, or electronic. Very accurate synchronization is possible depending on the sensitivity of the signaling arrangement and the valve it controls.

This cable arrangement causes valve *A* to bleed off fluid from whichever cylinder tends to move faster. Valve *B* permits valve *A* to perform this function for cylinder motion in both directions. The need for valve *B* is quite often overlooked.

A difference in loading is not a factor because correction is not a function of pressure. When moving together, both actuators will stop when either meets solid resistance, providing valve *A* can pass full pump delivery.





Efficient meter-in system for a molding press

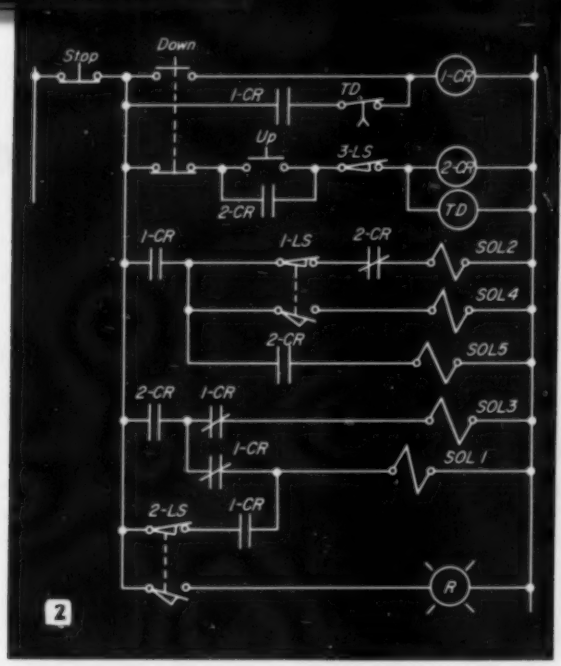
• By Don Arnold, *Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio*

ONE disadvantage of meter-in flow control is that the pump dumps excess fluid over the relief valve at high pressure. This results in wasted power, low efficiency, and heat. To keep high pressure pump output to a minimum, Adamson United engineers have used a variable volume pump with pressure-compensating control.

This control automatically regulates the delivered volume according to system pressure by changing the stroke of the pumping pistons. When the pump is working at a pressure less than the setting of the compensator, it delivers full volume. When system pressure reaches the compensator setting, the compensator shifts the pump to near-neutral stroke, so that the pump delivers only the amount of fluid necessary to make up leakage and maintain this pressure. Connected in a meter-in circuit, the pump delivers only the fluid which can flow through the flow control valve, and no excess fluid is dumped over the relief valve Although holding time ranges to 20 minutes, no heat exchanger is needed. This is proof of efficient circuit design.

• **Individual Pressure Control**—The circuits to the main ram and the two kicker cylinders are separate and supplied through individual pressure reducing valves. The pressure reducing valve for the kicker cylinders permits using lighter duty cylinders than would be required if high pressure were applied to them. The pressure reducing valve for the main ram circuit permits adjusting this pressure for different jobs. Nominal ram pressure is 2300 psi which produces a force of 1450 tons on the 40-inch ram.

Decompression of the 217 gallons of high pressure fluid is initiated when the UP pushbutton is pressed. This energizes the solenoid-operated decompression valve and a time delay relay. At the end of the timed decompression period, the relay de-energizes the decompression valve and the press begins its *up* stroke. ▼▼▼



1

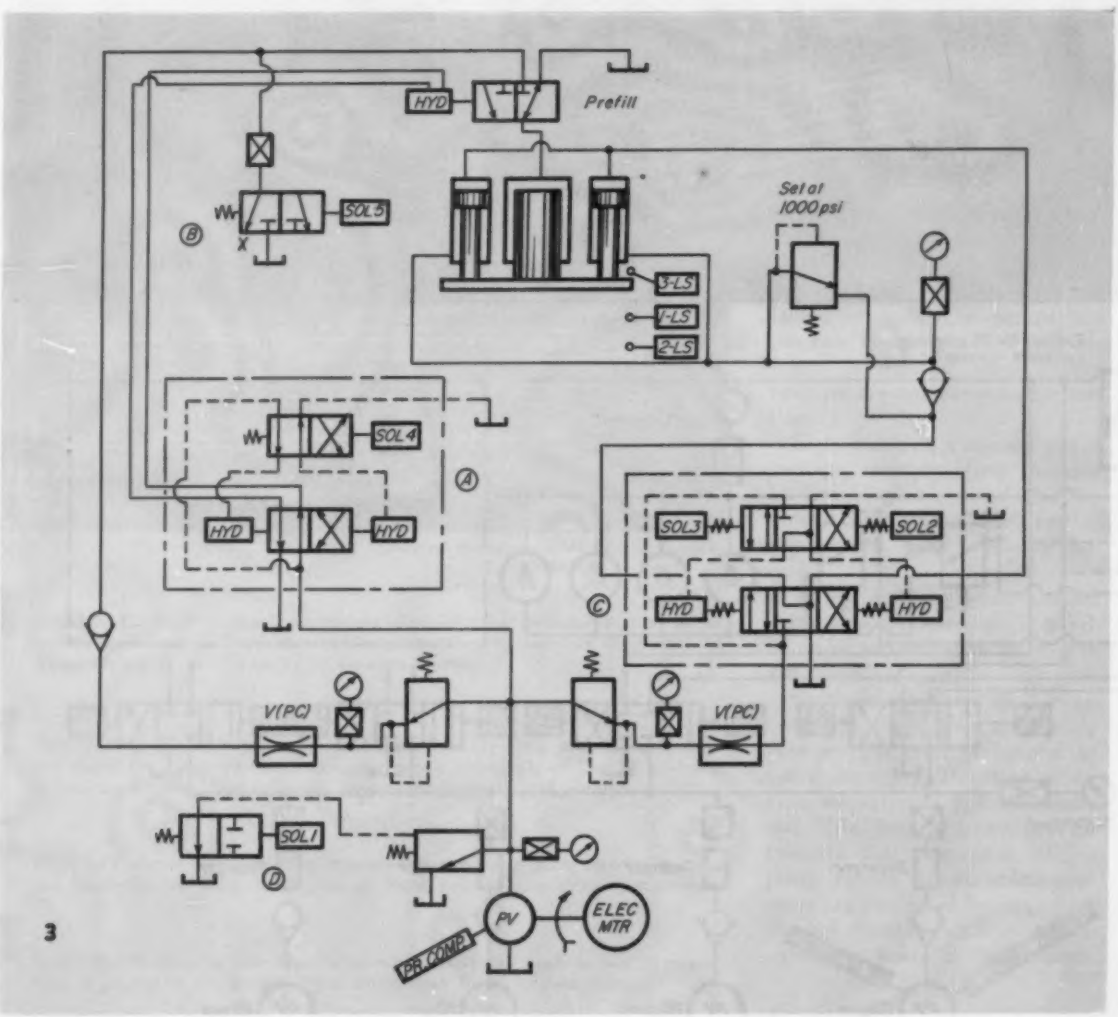
HYDRAULIC CONTROLS are manifold mounted above the electrical control panel of this 1450-ton press. 15-hp motor and 10-gpm, variable volume pump are mounted on the 400-gal tank. Hydraulic power unit is supported on structure beside the press for space saving and simplified piping.

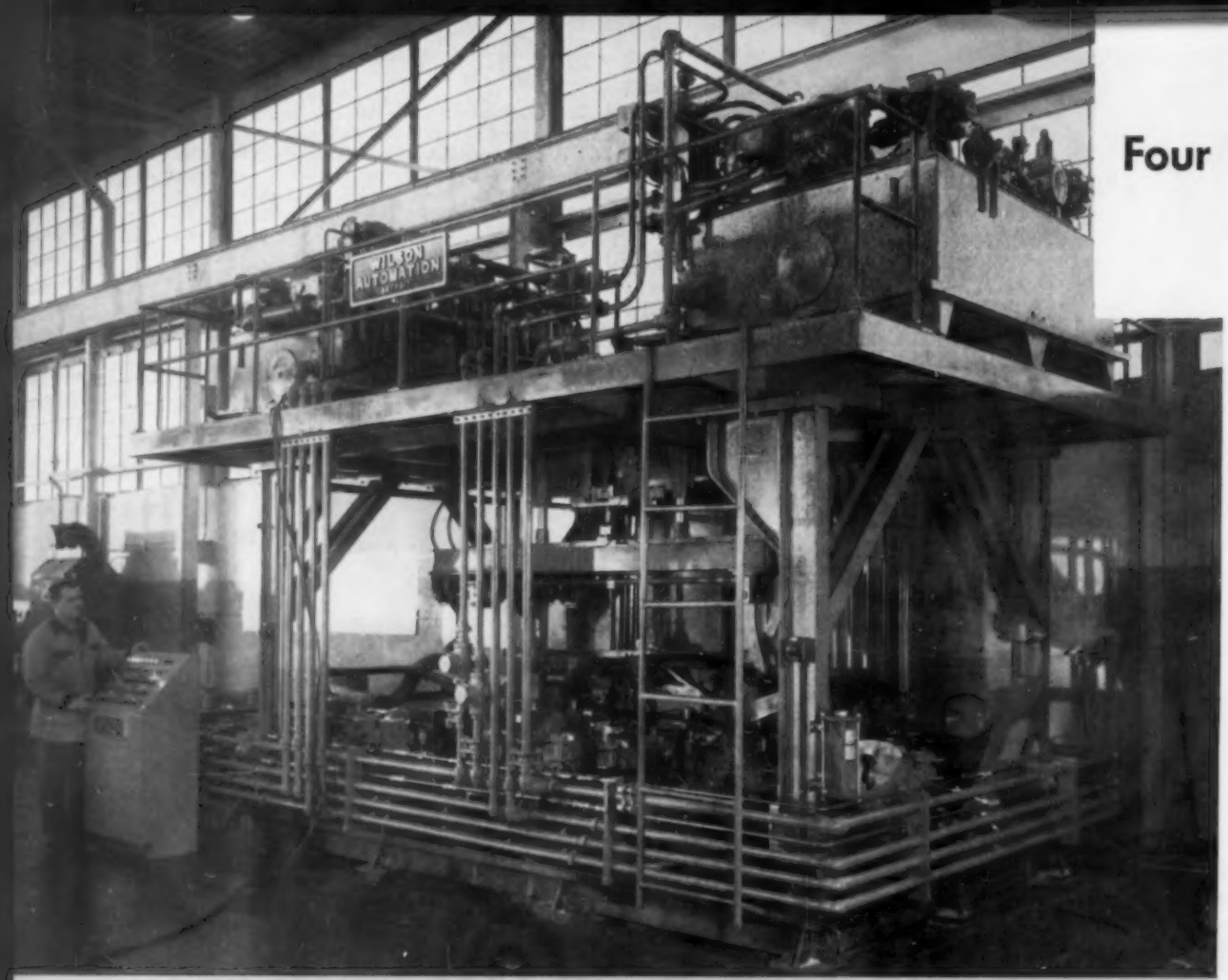
2

THREE LIMIT SWITCHES CONTROL PRESS ACTIONS after operator presses UP or DOWN pushbuttons. Limit switch 1-LS is actuated just before press closes to drain kicker cylinders and apply high pressure to ram. Limit switch 2-LS is actuated at completion of press closing stroke to unload pump. Limit switch 3-LS opens at top of press up-stroke to reset electrical system.

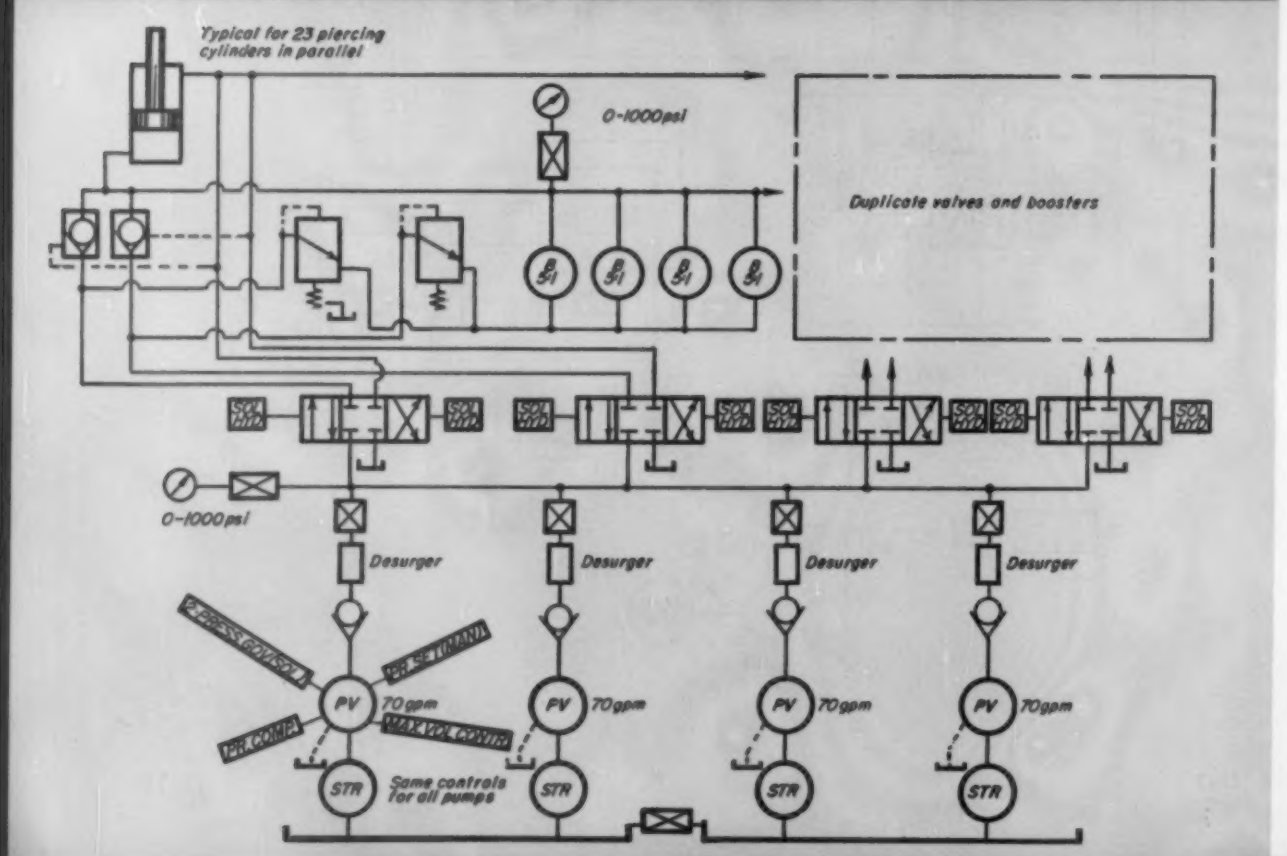
3

4-INCH PREFILL VALVE is pilot-operated by valve *A* which is actuated by limit switch 1-LS when press is nearly closed. Decompression valve B is actuated by UP pushbutton and is deactuated by time delay relay. Solenoid valve *D* is actuated when press is completely closed to unload the pump through the vented relief valve.




WILSON
AUTOMATION

Four 70-gp


Typical for 23 piercing cylinders in parallel
0-1000psi
Duplicate valves and boosters
0-1000psi
Desurger
Desurger
Desurger
Desurger
PV
70gpm
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STR
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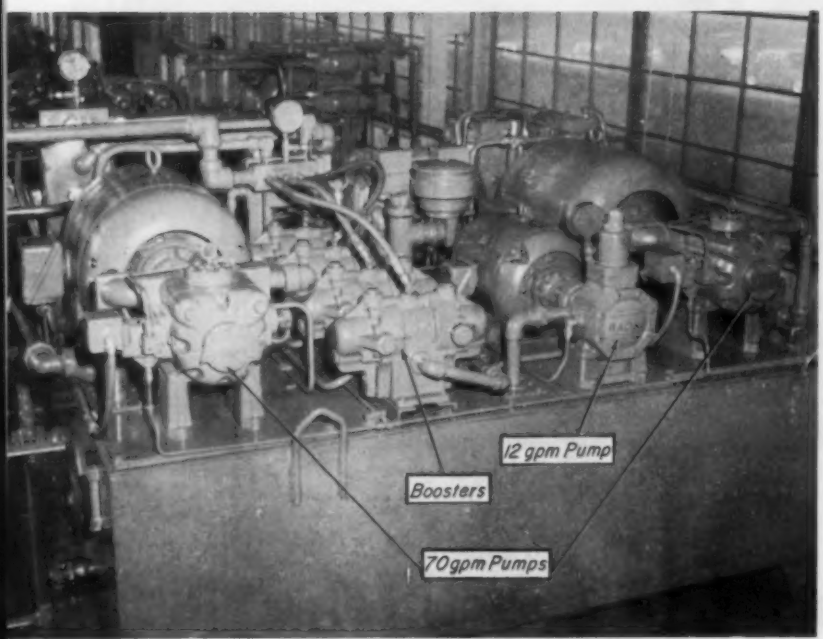
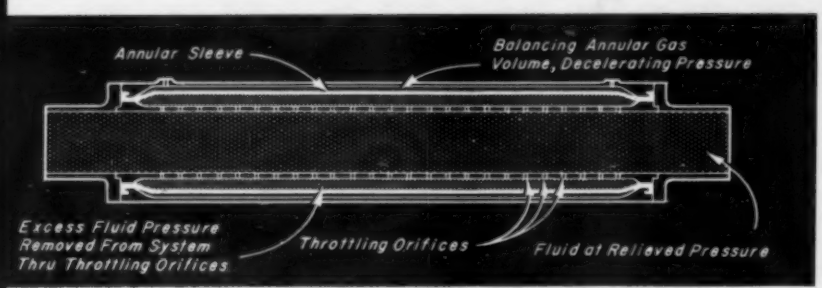
Same controls for all pumps

0- gpm variable pumps power piercing tools




Annular Sleeve
Balancing Annular Gas Volume, Decelerating Pressure
Excess Fluid Pressure Removed From System Thru Throttling Orifices
Throttling Orifices
Fluid at Relieved Pressure

Courtesy Westinghouse Air Brake Company

1 **FRAME PIERCING machine, shown during construction, is now in an automation line at Ford Motor Company. In 2½ seconds it pierces 23 holes (from ⅝ to 1½ inch) in an auto frame.**

2 **BOOSTERS multiply pump pressure by 5 to develop piercing pressure. Oil from the large pumps power the rapid approach of the 23 piercing cylinders. Small, 12-gpm pump powers positioners and clamps.**

3 **CIRCUIT shows how piercing machine can be run with one pump out for servicing. At least three pumps must run to give rated production.**

4 **DESURGER absorbs shock when pump shifts from high to low pressure. One is placed in the pressure line from each large volume pump.**

IT TAKES 160 gpm to close the 23 pierce cylinders on the automobile frame piercing machine built by Wilson Automation in Detroit. "We designed the power packages so that there is no downtime if one pump fails," said Harry Field, design engineer at Wilson. "Each variable volume pump has a maximum delivery of 70 gpm. They are set at 40 gpm for rated production. This means, that when a pump goes bad you don't have to shut down the line to work on it. You can reset the other three pumps to maintain output of the automated frame line.

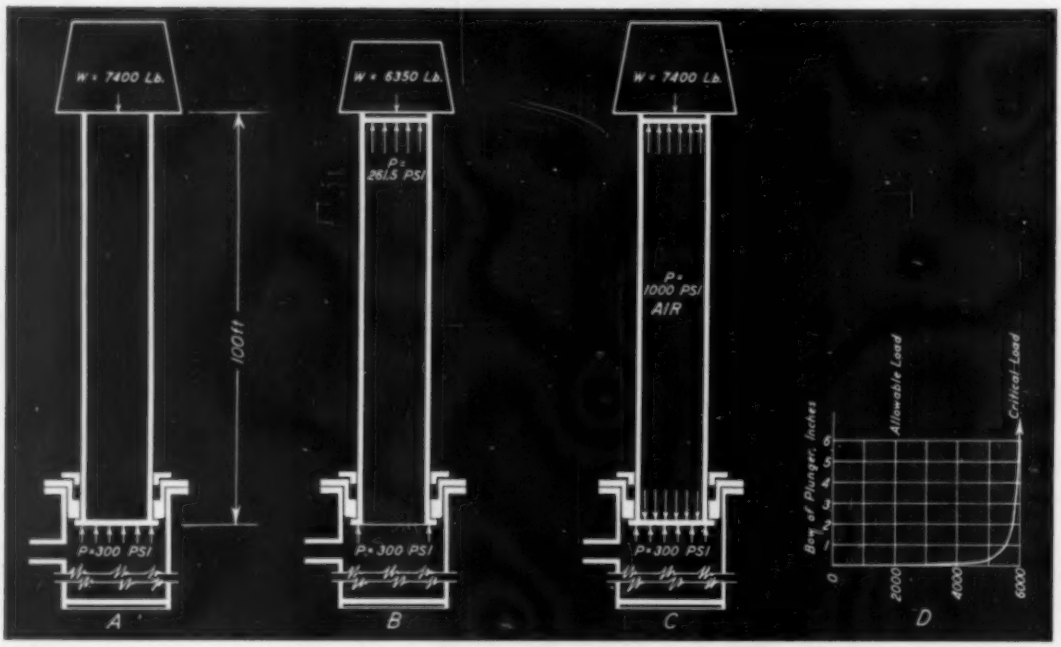
FLEXIBLE PUMP CONTROLS

Output of these pumps is readily adjusted. A manual adjustment sets maximum delivery. A two-pressure governor gives maximum delivery at 150 psi or 600 psi depending on the actuation of a solenoid control. The pumps are pressure compensated so that delivery is reduced when system pressure reaches compensator setting.

Eight boosters, 4 on each power package, multiply pump pressure by five to give a metal piercing pressure of 3200 to 4000 psi depending on pump pressure setting.

By putting the subplate-mounted directional control valves in parallel, valve and line sizes are held to 1-¼ inch.

Shock in the hydraulic system, caused by rapid change in pump pressure has been eliminated by using desurgers. This tubular device, measuring 4-¾-in. diameter and 23-in. long, is piped into the pressure line from each 70-gpm pump. During surges, excess pressures are dissipated by forcing oil through throttling orifices and expanding a sleeve in the desurger. ▼▼▼



THREE METHODS of loading a column: A; With pressure applied to the bottom; B, With pressure through the column applied to the top; and C, Pressure applied to the bottom. 1000 psi air in column.

Will internal pressure stiffen hydraulic plungers?

OIL hydraulic elevator plungers of higher travels must be designed for stiffness against bowing rather than for compressive strength; they will bow rather than crumple if overloaded. Some designers have thought that relieving compressive stress on elevator plungers would increase the allowable load. This article shows that this is not so, and that the admission of oil to hollow plungers does not help to resist bowing, but merely adds useless load.

To illustrate, assume a 6½ in dia plunger 100 ft long. It weighs 2500 lb and has an inside area of 27 sq in and an outside area of 33 sq in. This leaves a net cross sectional area of 6 sq in. The hydraulic pressure is limited to 300 psi.

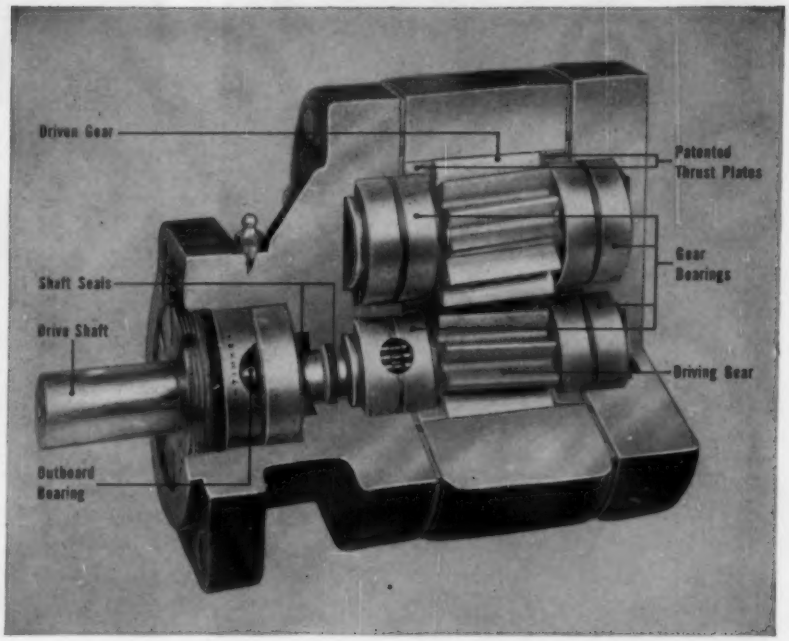
Total force at the bottom of column A is 300 x 33 or 9900 lb. Subtracting the weight of the plunger, the net available lift is 7400 lb. Compressive stress in the 6 sq in of plunger wall is 1650 psi at the bottom and 1234 psi at the top. At the point of most probable failure, in the middle, the stress would be 1442 psi, which is low for steel.

Column B has the same size plunger, but pressure is applied to the top by filling the plunger with oil. The pressure now acting on the top is reduced by the weight of the oil to 261.5 psi, however the full 300 psi is acting on the 6 sq in. of metal at the bottom. The upper portion of the column is in tension and the lower portion in compression. The load that can be lifted by the plunger is reduced by the weight of the oil being lifted to 6350 lb, assuming the oil weighs 38.5 lb per sq in. per 100 ft height.

To carry the pressurizing of the plunger to an extreme, assume plunger C is charged with air at 1000 psi. The pressure exerted at each end of the plunger creates a 4500 psi tension in the wall. This tension minus the 1234 psi compression at the center of the column leaves 3266 psi tension at the point of most probable failure.

The plunger resists bending by *difference* in stresses on inside and outside of bend. This difference is not changed by adding to or reducing total stress, so the internal pressure cannot help in stiffening the plunger; weight of oil inside merely reduces lifting capacity. ▼▼▼

ADVANCES IN HYDRAULIC PUMP DESIGN



Oil leakage controlled

In any method of mounting an oil-hydraulic pump there is always a certain amount of misalignment between the pump drive shaft and the shaft on the power source. Even where universal drives are utilized there is still the danger of a thrust load. Result in both cases: Flexing is transmitted into the pump seal and eventually to the bearings supporting the gear—leakage around the shaft is a sure-fire bet to follow.

At Commercial, by using an outboard bearing to protect the seals and internal bearings, the common leakage nuisance is eliminated.

Internal alignment perfected

Mass production of independent gear pump housing parts invariably results in varying degrees of internal misalignment—regardless of dowel pin control points used in machining. In many cases the "out" for the problem involves a loosening up on the internal tolerances —with a resultant loss in efficiency.

At Commercial, the patented thrust plate serves as a "natural" alignment control point—is counter bored on its face to match the bearing sleeve, then fits over the bearing sleeve and in turn pilots inside the gear housing. Perfect internal alignment—and increased efficiency—in any Commercial oil-hydraulic pump is axiomatic with rigid inspection of the thrust plate alone.

Constant volume assured

The principle of automatic adjustment of end clearance by internal pump pressure had one main weakness. The full pump pressure was applied against the whole area of each thrust plate. The plates would wear unevenly because on the inlet side of the pump the plate had full pump pressure on one face and a vacuum on the gear side.

By "pressure pocketing" Commercial insured that the pressures on opposite faces of the thrust plates would be in approximate balance around the entire area of the plate faces. Commercial's "one-two" advance design punch—the patented "pressure pocketed" thrust plate—assures constant volume at any pressure and at the same time helps to maintain simplicity of design and soundness of construction . . . provides for longer operating life and no maintenance headaches.

Seizing eliminated

Commercial oil-hydraulic pumps cannot seize because of heat induced by high speed or even inadequately piped systems. Variable end clearance and positive internal alignment make seizing practically impossible. Bearings evenly loaded throughout their length—no corner loading or spawling —are able to withstand much higher operating pressures. They stay in service longer too—regardless of pressures involved.

To take full advantage of tight internal tolerances Commercial designs, produces and grinds its own rotating gears—is able to hold extra close tolerances on tooth contours, outside diameters, and concentricity.

Over 5,000 different pump combinations—port locations and sizes—can be built from Commercial's standard line of oil-hydraulic pump components. A wide variety of drive shafts and mounting combinations are available to solve virtually any individual installation, piping and power application requirement.

Engineering help available

Commercial's oil-hydraulic pump engineering advances are typical of its complete line of oil-hydraulic equipment. The solid technical help Commercial sales engineers can contribute on the application of oil-hydraulic pumps, motors, cylinders and valves may be able to help cut your costs and improve performance.

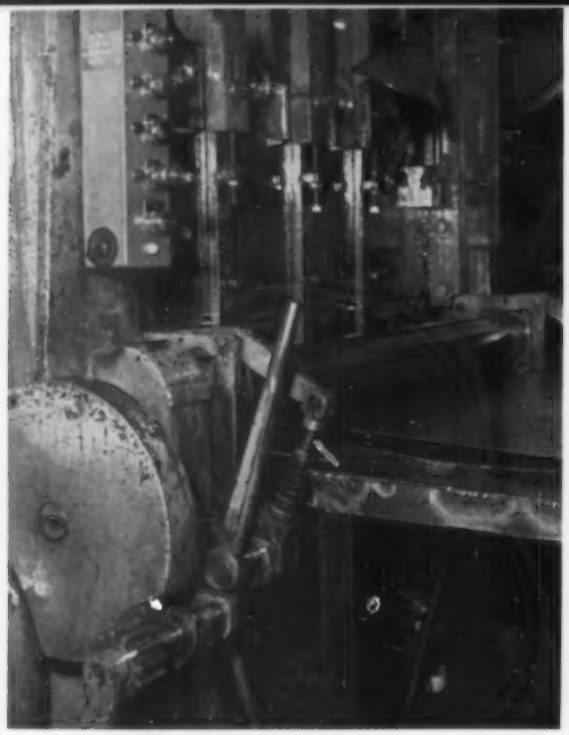
ENGINEERING DATA FREE

For more information write to Dept. A-18 Commercial Shearing and Stamping Company, Youngstown 1, Ohio. Better yet, send for your copies of Commercial's free engineering reference bulletins. Just check the items below in which you are interested.

- ☐ "Complete Oil-Hydraulic Line Catalog H-7"
- ☐ "Oil-Hydraulic Pumps and Motors Catalog H-4"
- ☐ "Performance Rated Oil-Hydraulic Valves Catalog H-12"
- ☐ "Oil-Hydraulic Cylinders Catalog H-3"

COMMERCIAL
shearing and stamping

CIRCLE 27 ON READER SERVICE CARD



FROM THIS . . .

TO THIS . . .

Cylinders load press rolls for high

• By Robert Rosencranz, *Chief Engineer, Standard Stamping & Perforating Co., Chicago, Ill.*

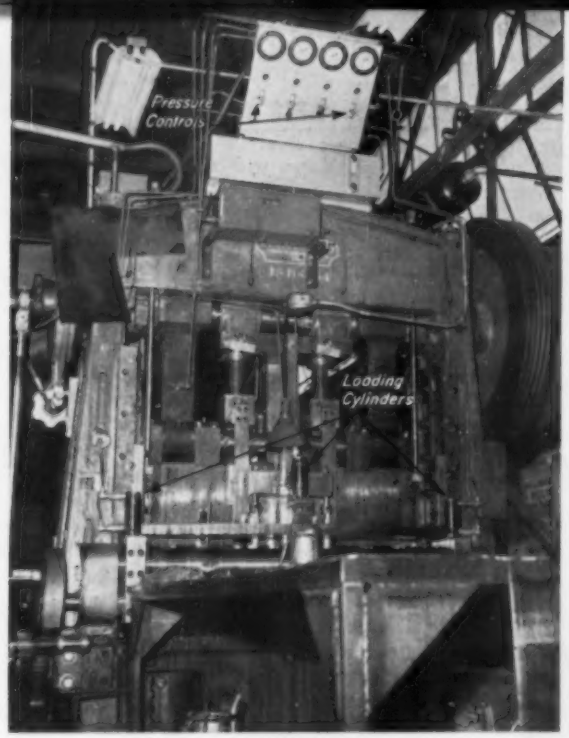
INCREASING speeds of feeding stock into perforating presses has required improvements in the method of loading the feed rolls. The recent trend toward coil stock and increased perforating speeds has aggravated the tracking and aligning problems of feeding a sheet of material through the press. The problems show up as lateral movement of the sheet or strip from the center pass line of the rolls. This lateral movement results in a drifting perforation pattern. The lateral drift can be so extreme that the edges of the sheet ultimately foul and bind against the side gages provided for accurate tracking.

Some of the factors that cause these problems are:

1. Inaccuracies in manufacturing the strip itself.
2. Inaccuracies in machining of the rolls.
3. Inaccuracies in the alignment of the rolls with one another.
4. Non-uniform contact pressures between rolls and strip.
5. Variation in die clearance which results in an uneven burr across the sheet, and therefore an uneven coefficient of friction laterally across the sheet.
6. Front and back rolls not parallel with each other.

A progressive program of improving press feeding has been conducted at Standard Stamping & Perforating in Chicago. Original design of the perforating presses had a hand-operated lever and linkage to load the feed rolls. The disadvantages of this system were: a. Manual effort required by the operator to raise and lower the levers; b. Necessity for operator to walk to machine's rear to lower and raise rear rolls; d. Difficulty in controlling loading by trial and error adjustment of springs.

A great improvement over the manually operated lift was the installation of air cylinders to replace manual operation. Two conveniently located 4-way air valves gave the operator effortless control over the front and back rolls, which were operated by the two double-acting air cylinders. However



TO THIS

speed perforating

the cylinders still acted through the cam lift, compression spring, and lever—the same linkage of the original design. In spite of the operating advantages, the operator was unable to accurately adjust force on the rolls.

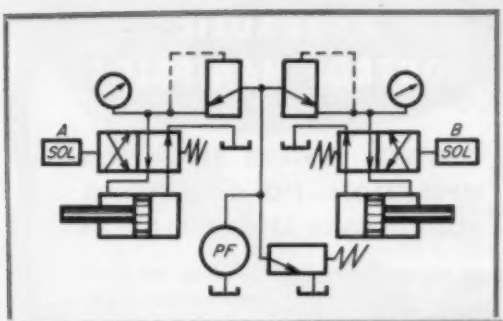
The difficulties of previous systems and problems of alignment at higher speeds have been largely overcome by the use of hydraulic cylinders exerting pressure directly on the upper roll bearings. Pressure reducing valves and 4-way solenoid-operated directional valves supply each cylinder, providing the operator with up-down control of the rolls, as well as individual pressure control. Pressure can be adjusted from slightly under 100 psi to 1000 psi. This gives actual hold-down forces from 300 to 3000 lb. acting individually on each of the four upper roll bearings.

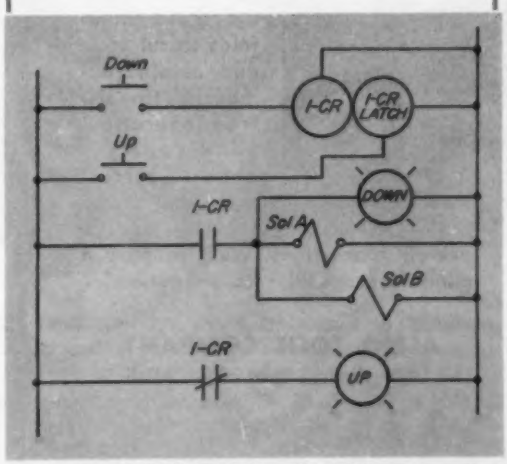
The pump, valves, and gages are mounted on top of the press. Controls for the pressure reducing valves project through a tilted panel on which are

ORIGINAL DESIGN of perforating presses had a lever-operated mechanism for loading the front and rear sets of rolls. This required considerable manual effort by the operator as well as trial and error adjustment of the springs for correct loading.

INSTALLATION OF PNEUMATIC CYLINDERS permitted easier raising and lowering of front and back rolls, but did not correct for inaccuracies in loading.

TWO CYLINDERS NOW LOAD each set of rolls at the bearings. Forces are accurately controlled by adjusting pressure reducing valves according to pressures indicated by gages. Middle cylinder has been added to prevent bowing of the roll by heavy gauge stock.





TWO-POSITION SOLENOID VALVES are energized by latching relays which are mechanically held in the actuated position after DOWN pushbutton is released. Auxiliary relay coils are energized by UP button to release mechanical latch. Circuits for one set of rolls are shown.

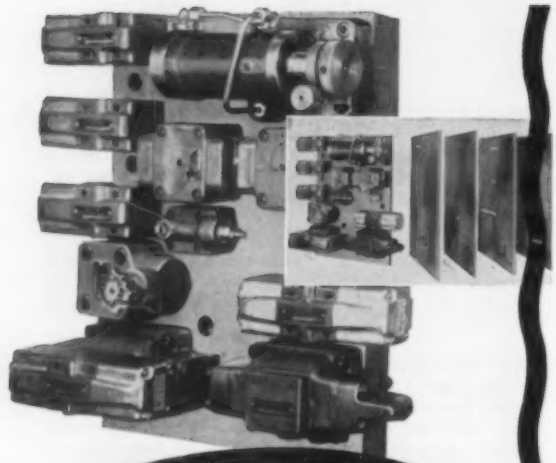
CYLINDERS LOAD PRESS ROLLS

mounted the pressure gages with signal lights that indicate whether each cylinder is under pressure or is retracted.

The electrical system for controlling the solenoid-operated directional valves makes use of latching relays actuated by momentary pushbutton switches. These relays have a mechanical latch which maintains them in the actuated position. They are released by energizing an auxiliary latch coil. Indicator lights in parallel with the valve solenoids show the operator whether the roll is in an up or down position without having to look at the rolls.

A further improvement that has recently been put in operation is a third cylinder acting downward on the center of the upper rolls. The action of this center cylinder offsets the upward forces exerted by heavy gauge material going through the rolls. These forces tend to bow or *crown* the center of the upper roll. The middle cylinder is connected to a semi-circular bronze bushing which rides on top of the roll. By using a similar control operating from the common hydraulic source, the operator can offset any uneveness caused by the bowing simply by varying the pressure on the center cylinder.

The advantages of the present system are in the wide range of loading forces which can be easily and accurately selected. With equalized forces on the stock, the tendency for lateral drift is avoided. ▼▼▼



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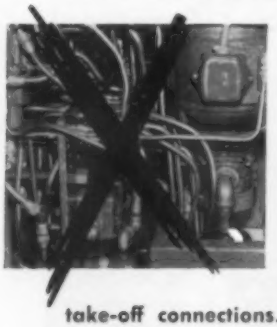

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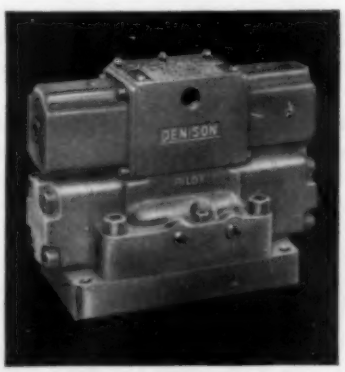

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7 Ways to unload a pump

• By Addison T. Smith,
The Airoyal Co., Maplewood, N. J.

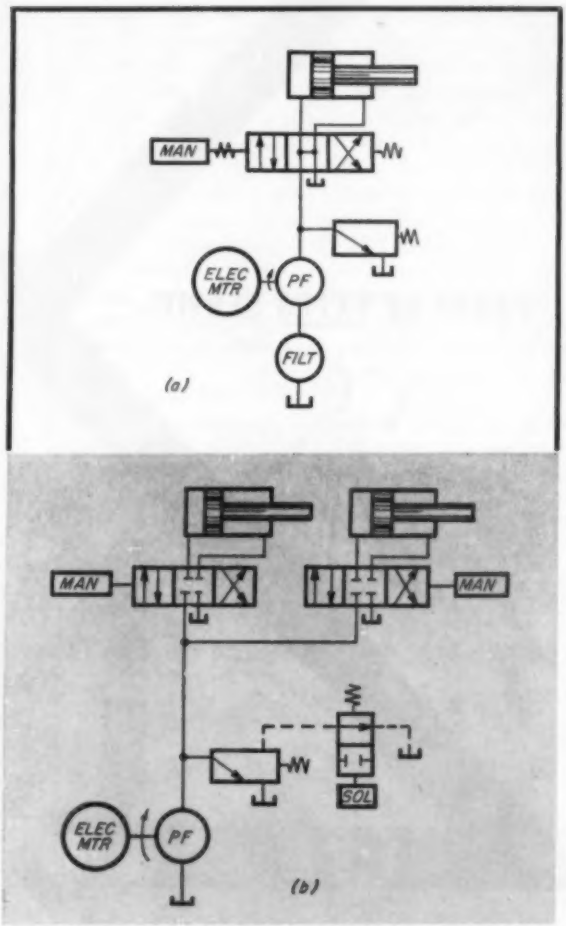
Excess heat and low efficiency result when pumps are not unloaded during idle periods. Unloading lets the pump output flow directly back to the tank with almost no resistance.

WHEN no useful work is being done in a hydraulic system, pump output goes into heat. This heat raises the temperature of the oil and all parts of the system. The heat must be removed somehow or it will thin the oil and cause poor system operation, or damage components. Also, this power is paid for because the power required to drive the pump for a given delivery at a certain pressure is the same, whether useful work is done or not.

These losses and the amount of heat generated can be measured. Hydraulic horsepower is found from hp = PQ/1714, where P = pressure, psi and Q = flow rate, gpm. A little quick figuring shows that 1 gpm at 2000 psi is 1.17 hp. If this amount of oil is going off the relief valve at this pressure, that power is wasted. In terms of heat generated, 1 hp-hr = 2545 BTU.

An unloading system lets output of the pump go directly to tank at almost zero pressure during the times when a hydraulic system is not actually working. Therefore, the power required by the pump is very small, even though it is driven at full speed and is delivering full output volume.

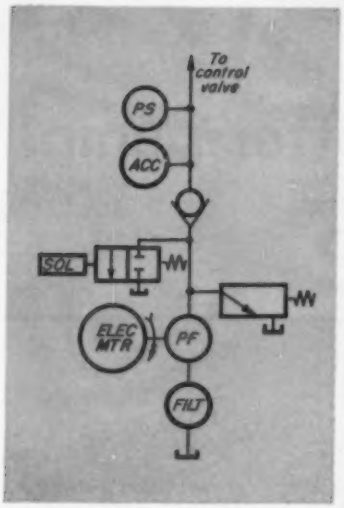
Of course, there are applications where work is being done so much of the time that unloading would not be necessary. However, most applications will be improved by unloading. ▼▼▼



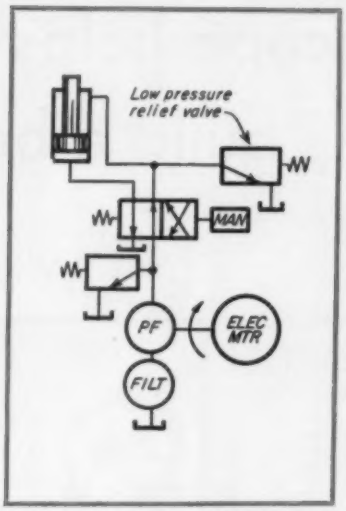
CONTROL VALVE UNLOADING—**One of the simplest ways of unloading is with an open-center valve, *a*. When the cylinder or hydraulic motor is not operating, the valve is in the center or "off" position. This connects the pump to tank. This setup is often used in mobile applications with the valve spring-returned to the center position so the pump will always be unloaded unless the valve control lever is held in one of the operating positions.**

When more than one cylinder or motor is powered by the pump, tandem-type valves are used, *b*. This way the pump is unloaded only when all the valves are centered. These valves are often supplied as two or three valves in a single housing with interlocks so that only one valve at a time can be operated.

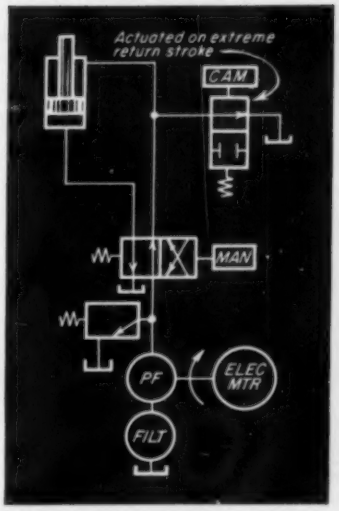
Control valve unloading is seldom used in industrial applications because more than one operation at a time is often required. Also, long dwell periods, as in pressing operations make it inconvenient for the operator to hold the control handle.



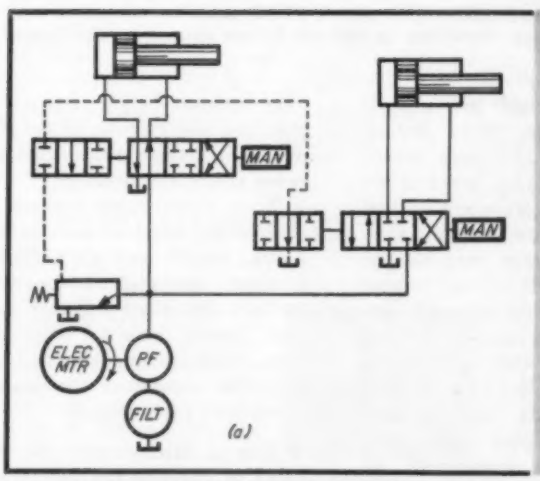
ACCUMULATOR SYSTEM UNLOADING—Where accumulators are used, unloading is controlled by pressure in the system. A pressure switch operates the two-position, two-way valve when pressure setting is reached. Pressure drop to reset value closes the valve and again loads the pump.

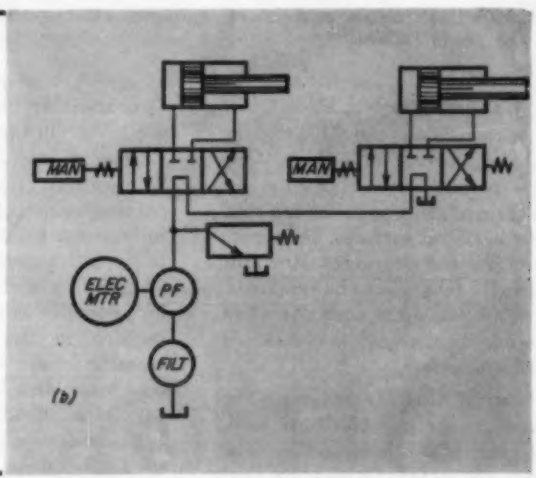


RELIEF VALVE UNLOADING—Operator time can be saved with this simple system for unloading at the end of cylinder return. The relief valve on the outlet side of the cylinder is set just high enough to return the piston. Increased pressure when the piston bottoms opens the low-pressure valve. This way the operator need not hold a spring-returned, open-center valve in position for the return stroke and may go on to other tasks. Pressure required for piston return must be very low for this circuit to be worthwhile.



MECHANICAL UNLOADING—A cam-operated two-way, two-position valve may be used to unload when the piston bottoms on the return stroke. This system may be used when piston return pressure is high as it would be if rod side area were very small to cause rapid return.





MULTIPLE-CYLINDER SYSTEM UNLOADING—When more than one cylinder is fed by a pump, position of one cylinder cannot be used to unload. In this case, three-position, two-way valves, operating in conjunction with the main four-way valves, are connected in series and unload the pump when all the four-way valves are centered. Since the two-way valves vent a relief valve, there is a limit to the number of valves which can be connected in series without pressure drop in the vent line causing unloading pressure to be high.

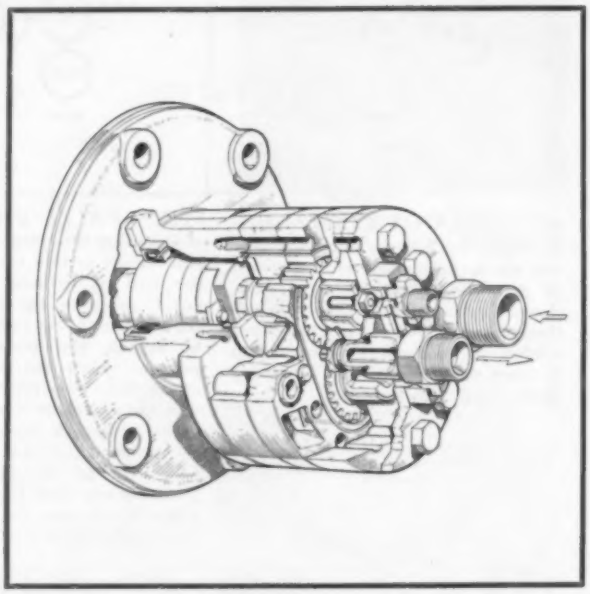
An electrical version of this circuit, *b*, eliminates this trouble. Limit switches are connected to a normally-open, two way valve which vents the relief valve. Switches are "off" when four-way valves are centered. If any control valve is not centered, two-way valve is closed by that switch. Electrical power failure will, of course, unload the pump.

How a microscope helps build a better pump

• By Ian McNeil, *Consulting Engineer, London, England*

SAMPLE & SOURCE	PRINCIPAL MATERIALS PRESENT	MAX PARTICLE SIZE THOUSANDTHS IN.
Filtered benzene after washing components	Iron oxide Carborundum	3.7
Kerosene filtered before use	Mainly fibers, but some metal particles	1.2
Lapping powder, coarse	Carborundum	4.5
Lapping powder, fine	Carborundum	0.5
Compressed air, as used	Iron oxides, some metal particles and fibers	12.0
Compressed air after addition of filter near point of use	Iron oxides	0.25

MICROSCOPE found sources of particles which caused pump failure.



HIGH PRESSURE GEAR PUMP must be assembled in very clean conditions to prevent failure caused by dirt particles.

PARTS machined to close tolerances is only the first step in the manufacture of a high pressure pump. Careful assembly comes next. Dirt particles can ruin fine machine surfaces and upset close fits and clearances. How can "clean" assembly be assured? Here's how we keep out dirt while assembling the gear pump shown in the drawing.

• **Pump Construction**—The gears are of case-hardened steel, integral with their shafts. The gears are surface finished by fine-grinding. Side plates are mild steel, nitrided, and lap finished. The center-plate thickness is 0.0006 to 0.001 inches greater than the gear width. This clearance is typical for 5 gpm pumps.

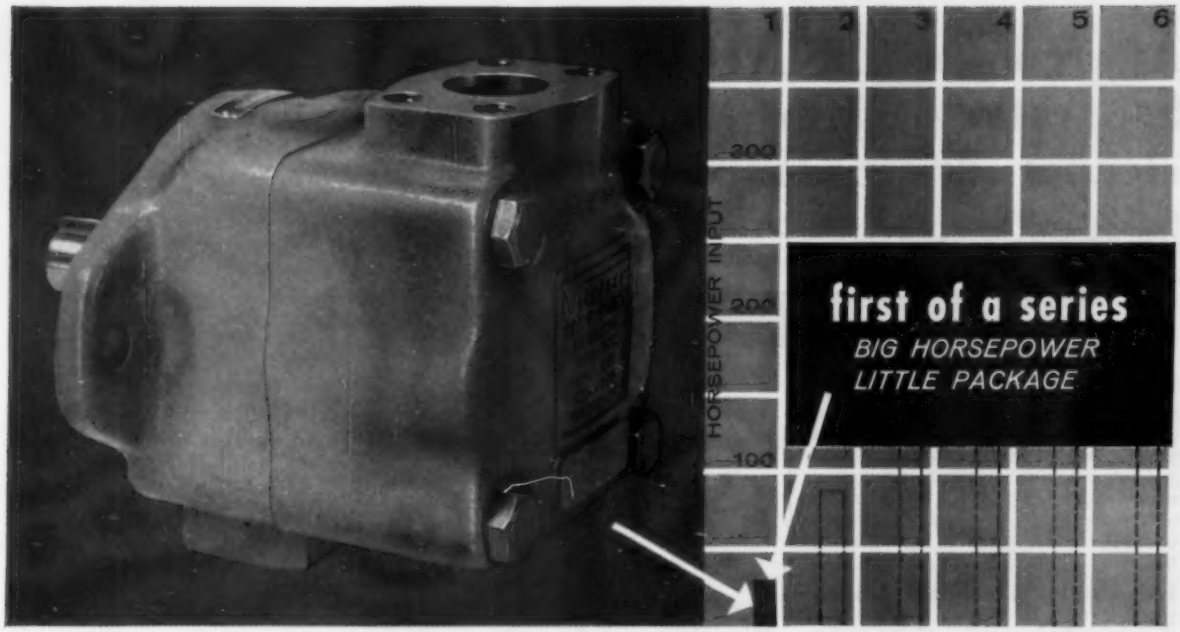
• **Clean Assembly**—We covered each assembly bench with a fresh sheet of brown paper before starting to assemble each pump. Component parts were kept covered in clean trays and washed in kerosene before assembly. Fine ports and passages were cleared of grinding and lapping residue by careful brushing and immersion in the kerosene. Final cleaning was with compressed air. Assemblers had to work only with clean hands. Only lint-free, high quality wiping cloths were used. By these precautions we thought we were ensuring clean work. We found out we were not.

• **Pump Failures**—Pumps seized repeatedly on test at continuous pressures of 2000 to 3000 psi and at intermittent pressures up to 5000 psi. They seized most often between the side face of the gear and one or both of the side plates. Sometimes they seized between shafts and bearings.

When a new pump was run at no load for one half hour to two hours, small but significant scratches appeared on the same surfaces that seized at higher pressure. Several times we lapped out these scratches and repeated the test. The scratches reappeared, often more pronounced.

• **Use a Microscope**—We decided to examine microscopically all parts and materials used during manufacture and assembly. The results are shown in Table 1.

We found that kerosene carried particles which were four times the clearance between the gear face and the side plate. Our com-



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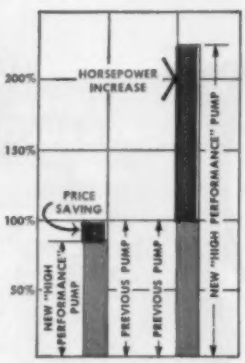
The complete line of "High Performance" pumps (both single and double) is being readied for release. Size range will accommodate your largest requirements. This first model of the series is available in three ring capacities; 12 gpm, 14 gpm, and 17 gpm as shown in table below.



Model Number	Delivery-GPM 1200 RPM 100 PSI	Delivery-GPM 2000 RPM 2000 PSI	Input Horsepower @ 2000 RPM 2000 PSI	Package Size†	Weight
2V12A-**10	11.8	17.8	25.5	L. 5⅜" W. 4⅝" H. 5¼"	26 Lb.
2V14A-**10	13.6	20.4	29.0		
2V17A-**10	16.6	25.2	36.0		

†Exclusive of Shaft Extension and Mounting Lobes

8050

Write for new illustrated Bulletin No. M5108 for further details and performance characteristics.

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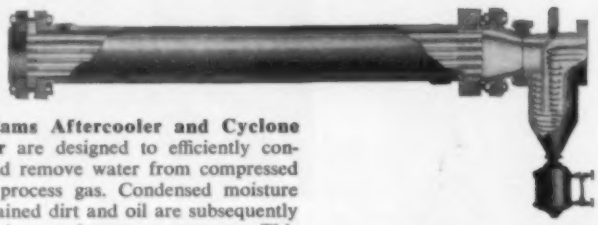

The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

HOW A MICROSCOPE HELPS

pressed air supply was even dirtier. The air was filtered near the compressor with no further precautions other than moisture traps in each branch line. Rust caused by moisture in the main lines no doubt caused the considerable quantity of large iron oxide particles that were found in the supply.

• **Cures**—New air filters were fitted as near as possible to each point of use in the pump assembly shop with only a short length of flexible pipe to each air tap. Laboratory grade Benzene was substituted for kerosene for washing components before assembly. Although more costly than kerosene, the benzene is almost entirely free from solid particles and is more effective for taking off the medium that is used in lapping pastes.

• **Results**—The mysterious scratches no longer appeared and the number of seizures on the test bed dropped to nearly zero. ▼▼▼

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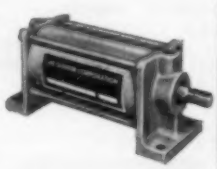

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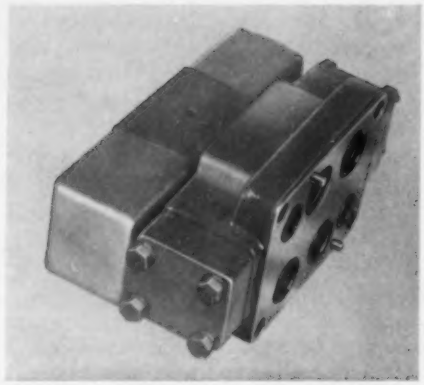

FIG. 1. PORTS OF A SUBPLATE mounted valve are unthreaded and mate with holes in the subplate. Since pipe or tubing connects to the subplate, piping connections need not be disturbed to change or repair the valve.

Flanges and subplates

• By John J. Pippenger,
Double A Products Co., Manchester, Mich.

SUBPLATE mounted valves, Figure 1, or valves connected in a hydraulic system with flange fittings may be unhooked for repair or replacement without taking the whole piping hookup apart. If the pipe or tube fitting is screwed into the valve ports, it may take a lot of sweat to get it out. This is the best known reason for using subplates or flanges. However, there are other reasons.

• **Valve Sticking**—Experienced men know that most sticking valves have threaded ports and the cause of the sticking is overtightening of pipe or tube fittings which distorts the valve body. In turn, body distortion makes the plunger or spool stick. Since leakage is a problem in hydraulic systems, the urge to give the fitting one more turn just can't be resisted.

Although most valve sticking can be eliminated by using subplates or flange connections, body distortion and sticking are possible. Distortion can occur with flange connections when the valve is not adequately supported. With subplates, you get distortion when the subplate is installed on a rough or warped surface and pulled down tightly. This warpage is then passed on to the valve body.

• **Flange Advantages**—When flanges are welded away from the valve, there is no danger of heat warping the valve body. Often, larger pipe or tubing may be used, increasing circuit efficiency. Piping runs made up with flanged fittings may be quickly and easily taken apart for cleaning and pickling after assembly in place. This means assembly can be accurate without running the risk of dirty pipes.

Flanges and subplates use sealing rings or gaskets to prevent leaks at connections and make tightening much less critical than with threaded fittings. When threaded connections are converted to flanges and subplates, the changeover has often paid for itself in a year's time in fluid savings alone. Before, the change, the leaks were too small and the time to stop them too great to bother. Savings in downtime for maintenance are also outstanding. ▼▼▼

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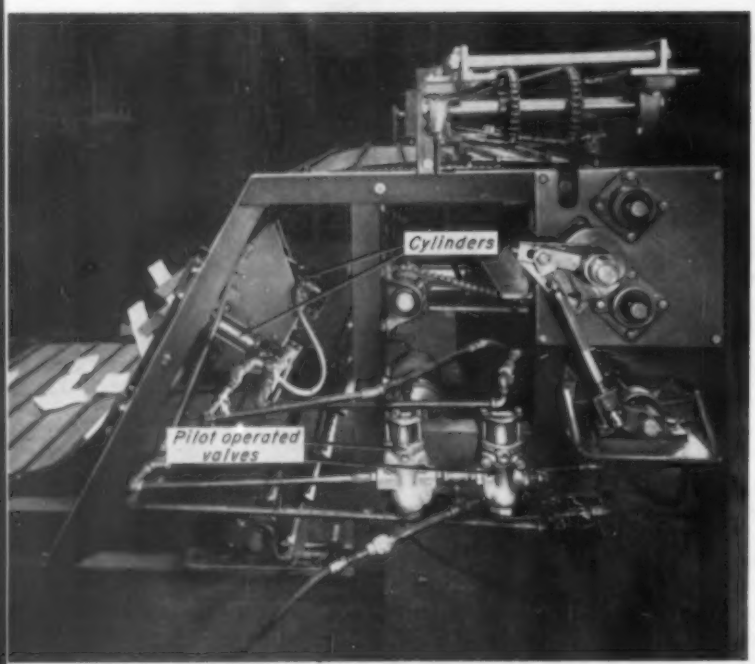
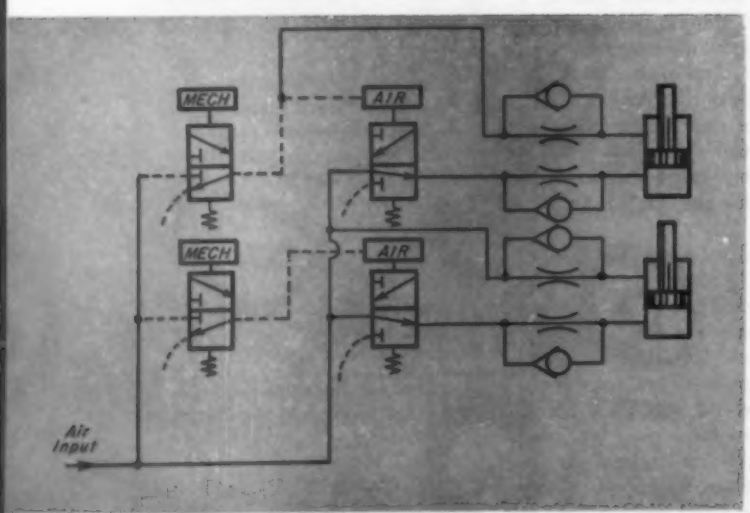
CIRCLE 72 ON READER SERVICE CARD

Cammed air valves unscramble moving parts





Information for this article was supplied by A. Schrader's Son Div. Scovill Manufacturing Co., Brooklyn, N. Y.

STACCATO action of two air cylinders synchronized with conveyor speed was accomplished with cam-actuated air valves. The machine was developed to unscramble rectangular paraffin blocks which were heaped in a pile. These blocks had to be rearranged for orderly packaging. Manually sorting these confectionery products was a tedious and costly process.

The machine is basically an inclined conveyor. Slats which are the same width as the blocks make up the conveyor, and ledges at the trailing edge of each slat hold the blocks as they move up the incline.

Two bars, each the width of the conveyor and linked to two cylinders, push through spaces in the conveyor and knock down any blocks which are vertical instead of horizontal. These fall down on the lower slats of the conveyor to try the trip over again, like salmon fighting their way upstream to spawn. Blocks which are horizontal are unaffected and travel up to a transverse conveyor at the top.

The cylinders which actuate the bars must act very fast not to interfere with the conveyor. Since the upper bar must knock down any blocks left standing by the lower bar, it must act through the same space and slightly after the lower bar.

• **Air System**—The cylinders are synchronized with the conveyor by cams which actuate 3-way pilot valves and are geared to the conveyor drive. Normally-open, air-operated, 3-way valves control air flow to extend the cylinders. Air flow to retract the cylinders is controlled by the cam-actuated valves.

Fast action of the valve and cylinders is obtained by the cam design. For most of its rotation, the cam holds the valve open to keep the cylinder retracted. At the proper time, the cam releases the spring-loaded valve which snaps to its normal position. This deactuates the pilot-operated valve and extends the cylinder. The cam valve is then actuated to retract the cylinder.

Positioning of the cams on their shaft insures that the cylinders will act at the right time. Flow control valves metering the exhaust of each cylinder adjust for the necessary speed without breaking the paraffin blocks. ▼▼▼

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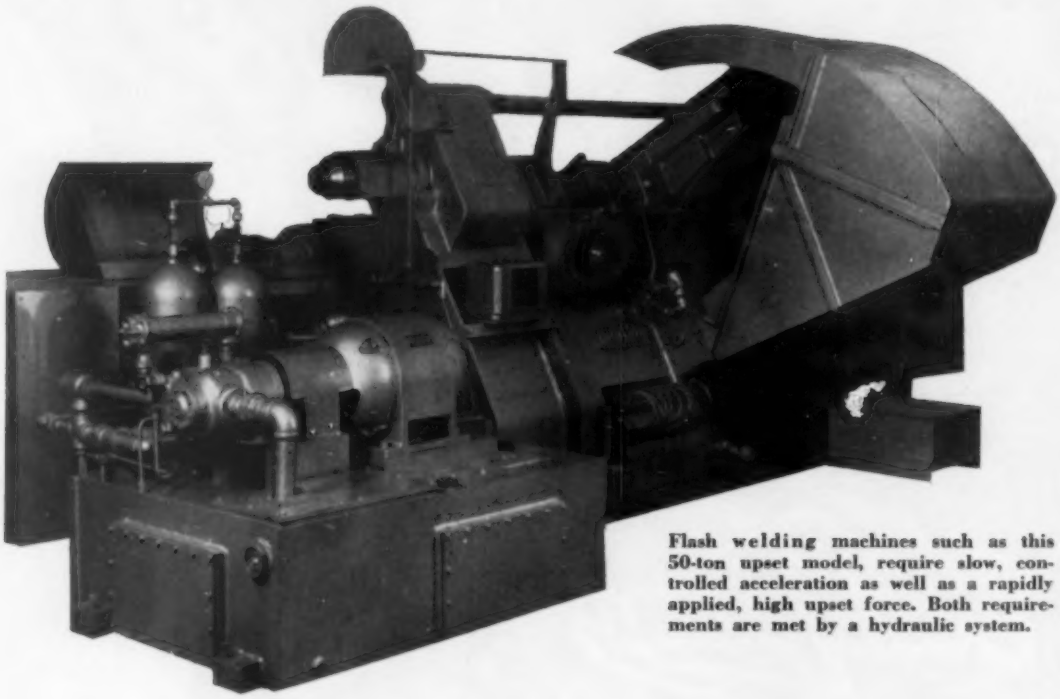
Operation of a flash welder requires smooth acceleration during heating. When the pieces are at proper temperature, they are pushed or forged together. This forging process requires large amounts of energy in the shortest possible time.



Flash welding machines such as this 50-ton upset model, require slow, controlled acceleration as well as a rapidly applied, high upset force. Both requirements are met by a hydraulic system.

Mechanically actuated servo valve gives controlled acceleration

• By Hans H. Hansen, *Chief Engineer, Taylor-Winfield, Warren, Ohio*

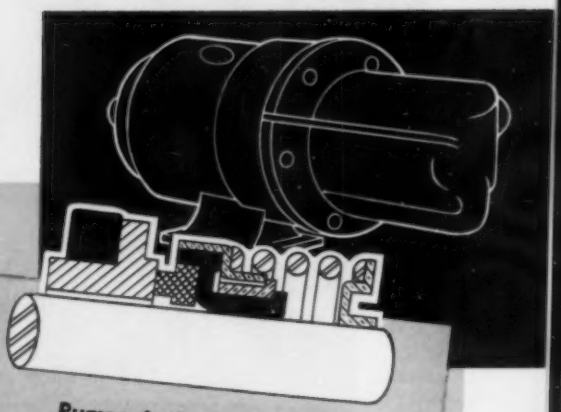
TWO valves control the operation of one work cylinder on a flash welder. One valve, a mechanically-actuated servo, meters flow to the cylinder for heating workpieces. At the end of the controlled movement during heating, a limit switch energizes a four-way directional valve to allow high-pressure, full flow for forging the pieces together. Control of this "two-phase" cycle is cleverly accomplished by coordinating mechanical and hydraulic devices.

• **Welding Requirements**—During the heating or flashing cycle of the flash welding process, the two pieces to be joined are heated by an electric arc maintained between them. Material is burned off the pieces during this operation, so they must be moved toward each other to keep a constant gap and maintain the arc. Rate of burning is not constant since the flashing becomes more violent as the pieces get hotter. Therefore, the movement must

CIRCLE 47 →

Machine Tools And Power Transmission Equipment

STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.



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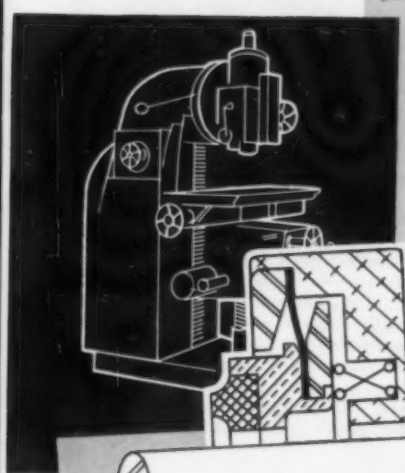

Heavy Machine Tools

STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.

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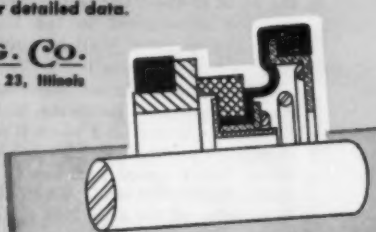
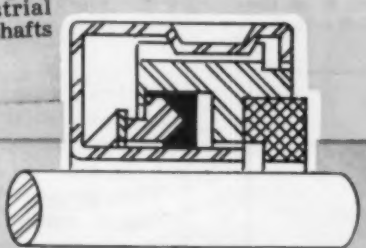


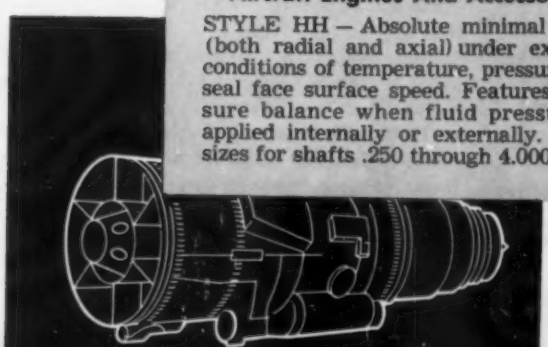
Household Appliances

STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.



Aircraft Engines And Accessories

STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.



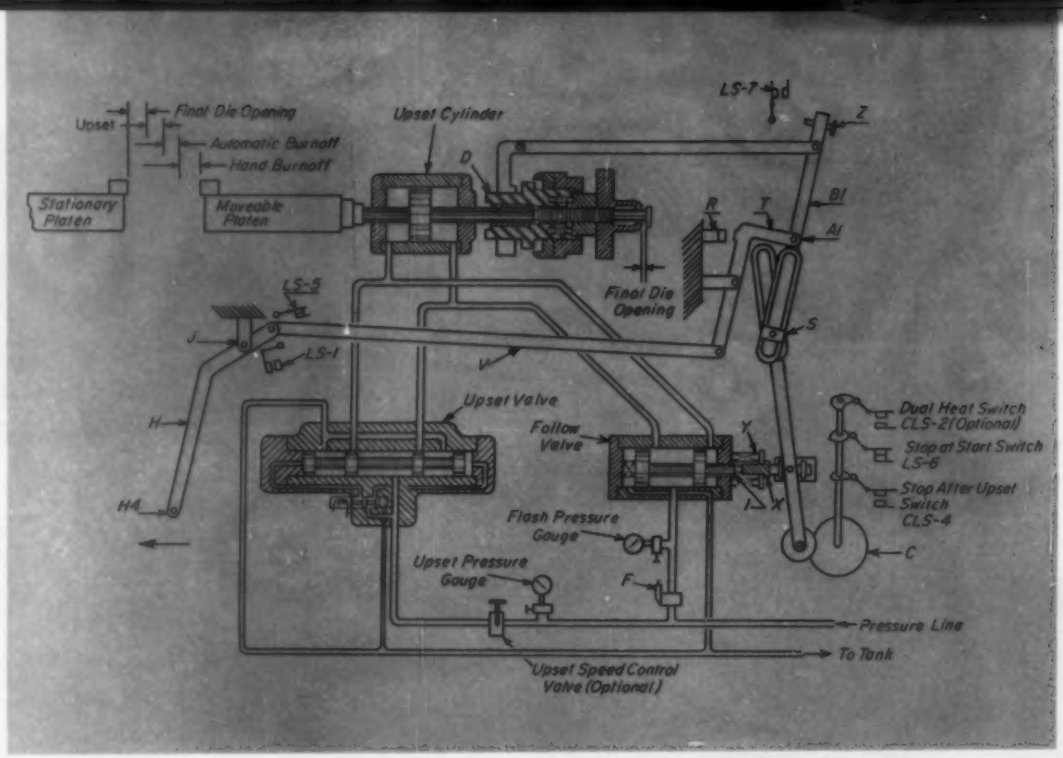


FIG. 1. Control linkage is shown at the start of hand burn-off. As the operator moves handle *H* to the left, it pivots about point *J* moving bellcrank *T* by means of link *V*. Bellcrank *T* causes point *S* to move to the left and the link connected to the follow valve spool *I* to move to the left. This opens the valve to allow oil to flow to the right end of the upset cylinder. As the upset cylinder moves, sleeve *D*, which is linked to lever *B1* also moves. Resulting movement of lever *B1* moves the link connected to the valve spool to the right to close the follow valve as soon as cylinder position correspond to the initial handle position. Thus the operator must continue to move the handle to obtain continuing movement of the cylinder.

When the limit of movement of handle *H* is reached, a detent holds the linkage in this position. Linkage operates LS 1 when it reaches this position to energize the magnetic clutch which connects the cam drive. Valve spool position is then regulated automatically by the cam. When the follower is on the high point of the cam, link *B1* and the link actuating the valve are in a straight line and LS 7 is actuated. At this point, the follow valve is closed and the various links become inoperative. LS 7 operates the upset valve at this point to permit full pump output as well as discharge of the two accumulators to be delivered to the cylinder and cause it to move forward with maximum force and velocity. Cam shape for this portion of the cycle is circular and imparts no motion to the linkage. Another cam on the same shaft as the follow cam contacts CLS 6 to de-energize the magnetic clutch and stop camshaft rotation at the end of upset.

Work is then released from the clamping electrodes. Reversal of the operating handle then moves the spool of the follow valve to reverse direction of flow to the cylinder and de-energize LS 7 to close the upset valve. When the handle is moved all the way back to starting position, LS 5 is energized to start the cam drive and return the cams to starting positive where CLS 6 on the camshaft de-energizes the cam drive.

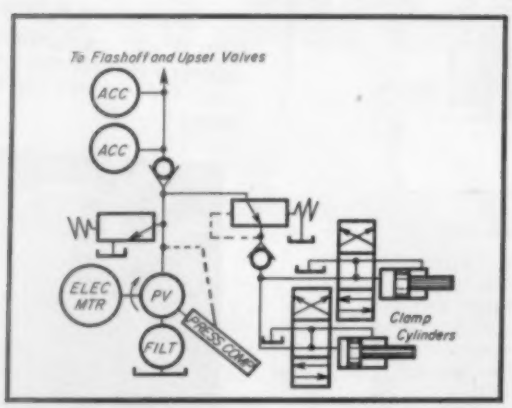


FIG. 2. Hydraulic clamping of the pieces to be welded is also used on flash welding machines. A pressure-reducing valve controls maximum clamping pressure.

be gradually accelerated. However, the acceleration must be extremely smooth since a sudden jump could cause the pieces to freeze to each other and stop the arc.

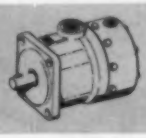
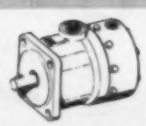
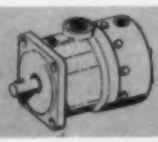
When proper temperature of the pieces to be welded is reached, process requirement changes from smooth control to brute force. Pieces to be welded must be jammed together with forces ranging from 5 to 750 tons, depending upon application and machine size. This must be done just as fast as possible to insure that all molten oxidized metal at the weld is squeezed out to the exterior of the weld before it can solidify.

• **Hydraulic System**—Depending upon machine size, the pumping or power unit can take different forms. Single, pressure-compensated pumps are used on small machines. A duplex pump setup consisting of a small-volume, high-pressure pump and

Concluded on page 99

DYNEX offers complete high pressure hydraulic circuits*

* for industrial and mobile applications

CIRCUIT SIZE	MAXIMUM PRESSURE	Power Pumps @ 1800 rpm	Relief Valves	Directional Valves
5 hp range	3000 psi	PF 3003 (2.6 gpm) PF 3006 (4.1 gpm)	VR 3108 VR 9103	VD 4103 (0-3 gpm) VM 3506 (0-6 gpm) VM 6506 (0-10 gpm) VM 6106 (0-8 gpm)
	4000 psi	PF 4004 (2.1 gpm @ 1200 rpm)	VR 3108 VR 9103	VD 4103 (0-3 gpm) VM 3506 (0-6 gpm) VM 6506 (0-10 gpm) VM 6106 (0-8 gpm)
15 hp range	3000 psi	PF 3008 (5.7 gpm)	VR 3108	VM 3506 (0-6 gpm) VM 6506 (0-10 gpm) VM 6106 (0-8 gpm)
	6000 psi	PF 6006 (4.2 gpm)	VR 6108	VM 6506 (0-10 gpm) VM 6106 (0-8 gpm)
30 hp range	3000 psi	PF 3016 (10.9 gpm)	VR 3120	VM 6512 (0-16 gpm) VM 6520 (0-30 gpm)
	6000 psi	PF 6011 (7.9 gpm)	VR 6120	VM 6506 (0-10 gpm) VM 6512 (0-16 gpm) VM 6520 (0-30 gpm)
45 hp range	3000 psi	 PF 3021 (14.7 gpm)	VR 3120	VM 6512 (0-16 gpm) VM 6520 (0-30 gpm)
	6000 psi	 PF 6015 (10.5 gpm)	VR 6120	VM 6512 (0-16 gpm) VM 6520 (0-30 gpm)
90 hp range	6000 psi	 PF 6028 (21.5 gpm)	VR 6120	VM 6520 (0-30 gpm)

Complete line of single and double acting cylinders for every application

All pumps have split flow feature to provide two or more separate circuits. Write for engineering data sheets on the above circuits and components.

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DOUBLE SOLENOID 4-WAY VALVES — Now double solenoid 4-way action available in full series . . . voltage-wise, port size, flow capacity. Permits longer dwell time in either position without continuous electrical energy.

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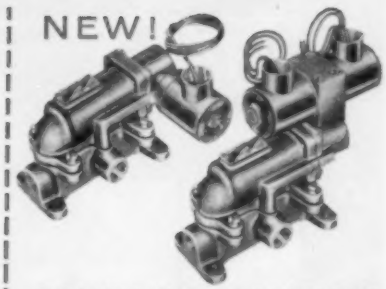

SUB-BASE SINGLE AND DOUBLE SOLENOID VALVES — Greater versatility. You don't have to disturb the piping for service. Reduces "down time" to absolute minimum. Complete series: voltages, sizes, capacities.

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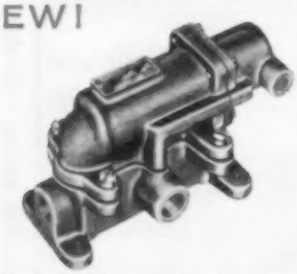

PILOT OPERATED SUB-BASE 4-WAY VALVES — Sturdy cast meehanite sub-base contains all ports for piping air. Permits removal of valve mechanism for service without disturbing piping. Complete new series!

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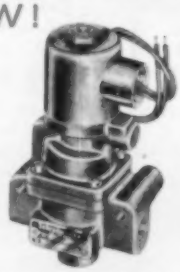

NEW! 3-WAY SOLENOID VALVES—Simple 3-way action available in full series—voltage, port sizes, flow capacities. By shifting pilot chamber head 90°, normally open changes to normally closed, and vice versa!

NEW!

2- AND 3-WAY FOOT VALVES — With right angle ports. Give convenience and control with simplest installation. Mount directly on floor. ⅜" N.P.T. Sturdy, compact, and *versatile*. Take minimum space.

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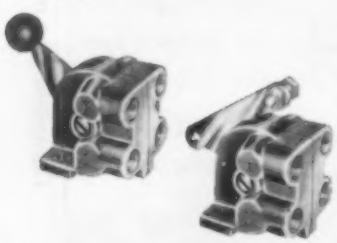

SLIDING SEAL VALVES FOR PIPED EXHAUST — Complete series! 2, 3, 4-way types. ¼" N.P.T. ports. Hand or mechanical lever. Compact, minimum working parts.

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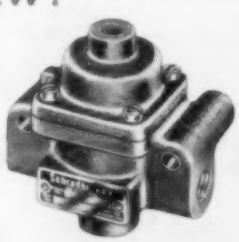

3-WAY PILOT VALVES — Complete new line. Normally open or normally closed types. Ideal for single-acting cylinders. Simple, neat, sturdy. May easily be converted to solenoid.

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CHECK VALVES—Thread combinations now in complete series in spring-loaded check type. Pinpoint your needs. Amazingly compact, relative to large flow capacity. Capacity 35 cu. ft.

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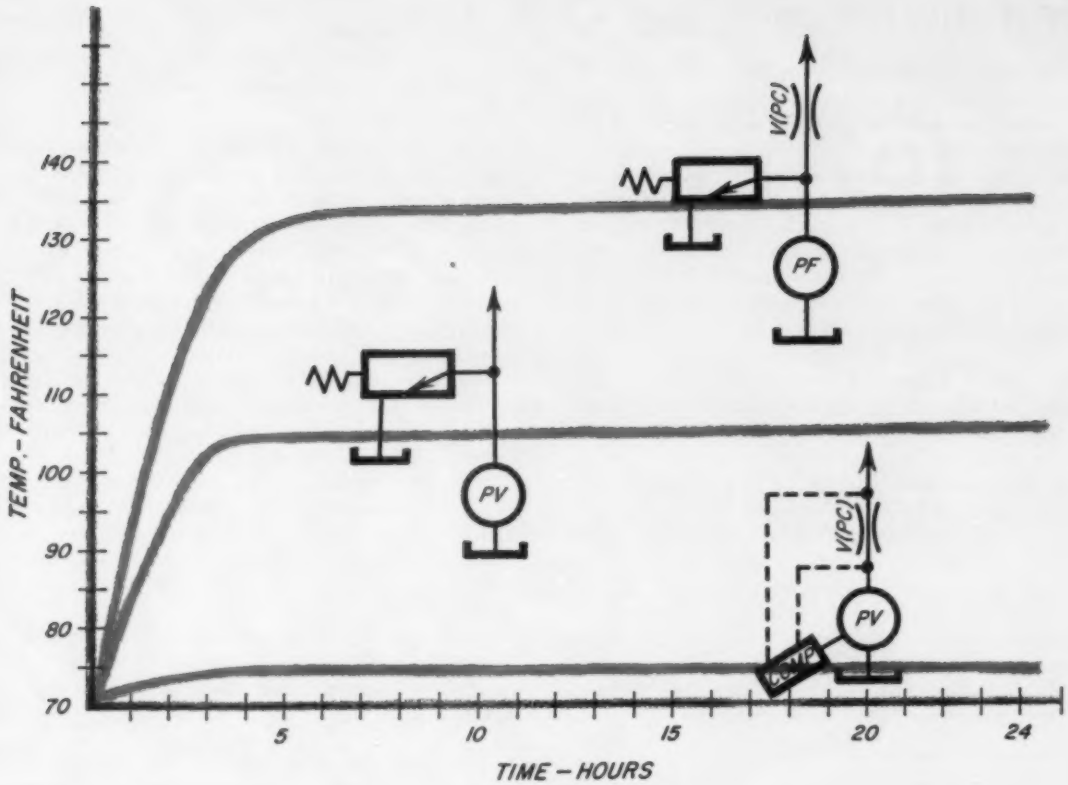
QUALITY AIR PRODUCTS

CIRCLE 106 ON READER SERVICE CARD



Production tests with a constant displacement pump, variable volume pump, and new, compensated pump showed that a . . .

Compensated pump reduces heat in a surface grinder

● By Fritz Krafft, *Chief Development Engineer*
Thompson Grinder Co., Springfield, Ohio

HEAT is especially troublesome in surface grinders where flatness and surface parallelism are critical. Coolant spraying the top of the table and hydraulic heat on the bottom produce expansion and contraction. The top stays below ambient temperatures—actually cool to the touch—while the hydraulic system in the bed of the grinder reaches temperatures 50 to 70 degrees higher than ambient. The heat travels to the bed, table, and column so that the top surface of the table contracts while the bottom expands. This results in distortion, and must be corrected to keep the work uniform.

Usually the grinder is warmed up early each morning before normal working hours so that it's up to working temperature at the start of the working day. Heat exchangers or refrigerators have been used to help control oil temperature, and many operations would be impossible without them.

In smaller grinders, such as tool-room machines and short-table, production grinders, this distortion is not so critical. Such machines carry a small load of work and fixtures, and table cycles are short. They usually have constant volume, hydraulic pumps working at a preset pressure. The work is

COMPENSATED PUMP REDUCES HEAT

intermittent, with no long production runs, and pressures are low.

Distortion becomes a problem in machines of approximately 40-inch work length, and increases in proportion to work length. Variable volume pumps are often used on these larger, production machines which may run continuously for two or three shifts. These pumps operate at a fixed pressure, but deliver only the volume of oil required for proper table speed and head movement. Load pressure in the system changes as the table travels in each direction, stops, and reverses. Although it operates at a constant pressure, the variable volume pump is better than the constant volume pump. However, it can also produce harmful temperatures.

• **Compensated System**—A new hydraulic system developed by The Thompson Grinder Co. and named *Hydra-Cool** has design advantages over both constant and variable volume systems. The pump is a variable displacement, vane unit. A sliding, spring-loaded rotor is actuated by a differential cylinder integral with the pump. Pressure drop across a meter-in flow control is applied to this cylinder (see circuit) so that pump output pressure varies according to load pressure.

This gives the relationship:

$$P_1 a = P_2 A + F_s$$

where:

P_1 = Pressure on the upstream side of the flow control valve

P_2 = Pressure on the downstream side of the flow control valve

a = Area of control cylinder rod end

A = Area of control cylinder head end

F_s = Spring force

If the flow control valve is closed, so that no flow is passed and load pressure drops to zero, pump pressure drops to that required to balance spring force in the stroking cylinder. The pump never pumps a greater volume or at a higher pressure than actually required by the load in each phase of the cycle. The sliding pump rotor mounted on antifriction bearings is positioned according to pressure and volume requirements.

The circuit contains no relief valve and operates at relatively low pressures. A pump of 20, 30, or 50-gpm capacity is combined with large-bore cylinders for the required force and speed.

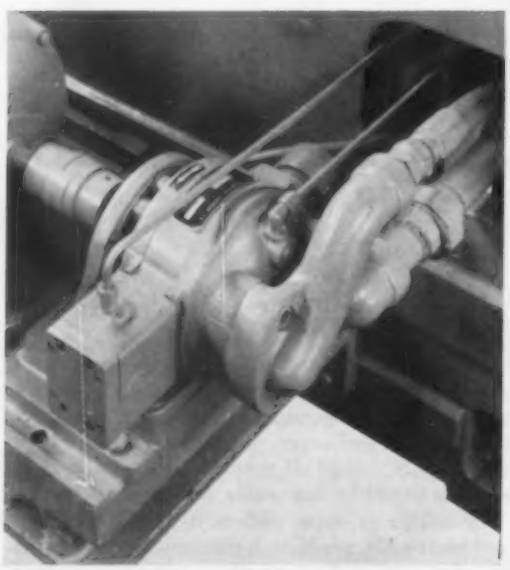
The system reduces heat by adjusting horsepower to work requirements. Cooler operation results in less oil sludge, and better performance. Because warm-up is almost eliminated, power costs are cut further and more time is available for useful production.

Machine distortion is almost entirely eliminated, and surface flatness and parallelism can be accurately maintained. This reduces scrap and shutdowns.

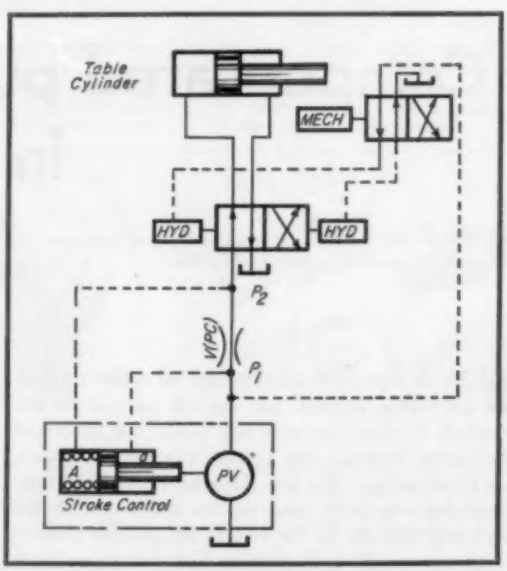
• **Test Results**—Tests to find out the relative value of the compensated pump system were made on a medium size surface grinder powered by a 3-hp hydraulic system. The normal working temperature of this machine was high because of se-

Concluded on page 99

* *Patent Applied For*

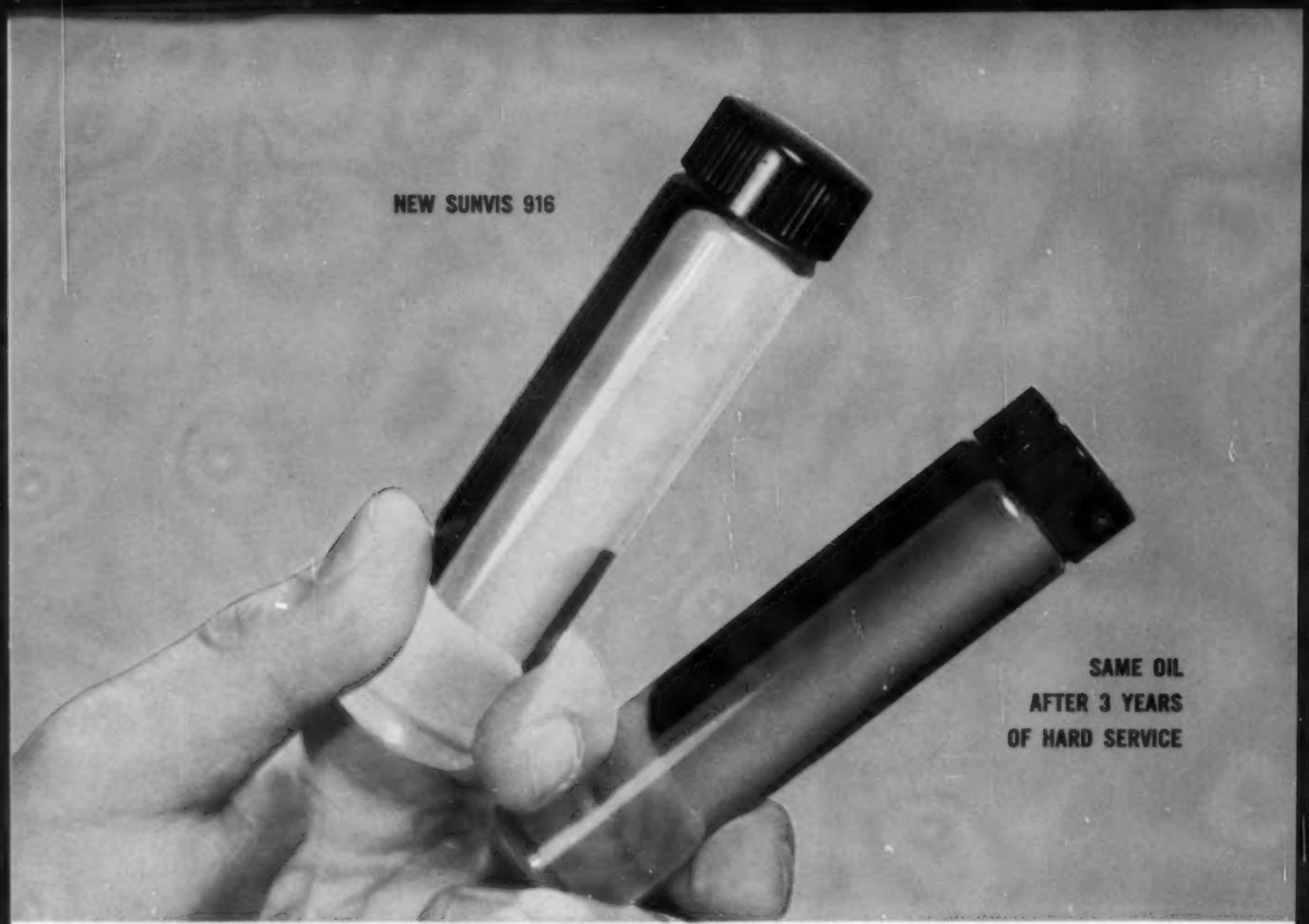


COMPACT VANE PUMP has integral stroke control for pressure and volume compensation. Heat generation is very low, therefore. Three sizes deliver 20, 30, and 50 gpm.



PRESSURE ON EACH SIDE of flow control valve is applied to stroking cylinder to control pump displacement. Grinder speed depends on flow control setting.

CIRCLE 116



Comparative Tests Prove . . .

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Versatile, long-lasting Sunvis® 900 oils are especially made to provide superior lubrication at high temperatures and in the presence of moisture. *They keep maintenance costs low.*

Time and again, when checked against new-oil specifications, used Sunvis 900 oils prove themselves fit for many more years of continued service, with *no* loss in performance features.

For example: The 3-year-old sample above was used in an injection molding machine operated for 40-48 hours per week at temperatures between 100 and 125 F. To see how the used oil compares with its original specifications look at the following table.

Specifications	New Sunvis 916	Sunvis 916 After 3 Yr*
API gravity at 60 F	30.5-32.5	30.3
Flash, open cup, deg F, min	400	400
Fire, deg F, min	460	460
Viscosity, SUS at 100 F	150-160	173.0
Viscosity index	90	90
Neut. number	0.10	0.05
Color, ASTM	1-1.5	3.5

*Typical Test

HOW TO GET MORE INFORMATION

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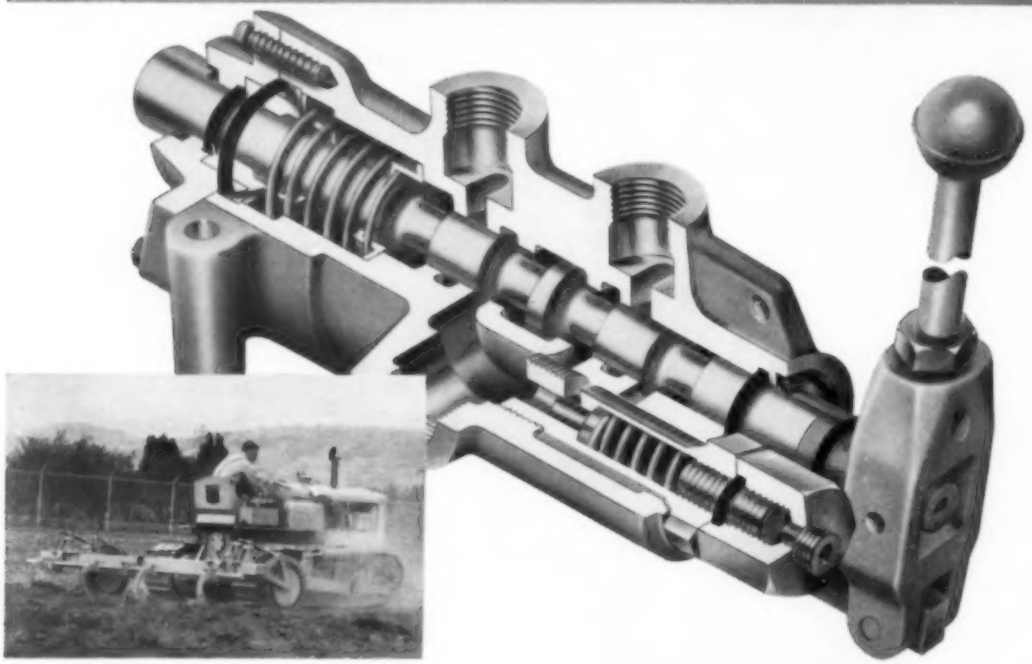
NATIONAL OIL SEAL LOGBOOK



Use of O-rings as moving seal in heavy duty bulldozer control valve

1,500 psi variation without backup rings. Intermittent operation plus long periods of inactivity. Extreme external dust and dirt conditions. Irregular and unpredictable field servicing. Fluid oil temperatures reaching 180°F. Climatic temperature extremes from —30° to +120°F. Life expectancy is required to be that of the tractor.

Above are the rugged operating conditions faced and met by National industrial O-rings in the new Be-Ge Model SU-1200F bulldozer blade control valve. A total of four rings are employed in each unit; two in a moving shaft application and two as static seals.

Be-Ge reports no leakage or ring failure on hundreds of heavy duty applications involving Oliver, Caterpillar, International Harvester and other crawler tractor installations.

National offers a complete line of industrial O-rings, plus many exclusive compounds. Special compounding is also available to meet unusual conditions.

For complete information on National O-Rings, or for skilled O-ring engineering service, call your nearest National Seal engineer. In major cities nationwide. See the Yellow Pages, under "Oil Seals".

Syntech® Oil Seals

Syntech oil seals, developed by and offered exclusively by National, are widely used synthetic rubber seals for applications where temperatures reach 250°F, speeds reach 3,600 FPM, and total indicator runout is as high as .030. Basic 50,000 series Syntech (illustrated) employs a tough, accurately manufactured steel outer case, precision-tensioned spring and accurately molded and trimmed Syntech sealing lip.

Micro-Torc Oil Seals

Micro-torc oil seals, pioneered by National, are sturdy, dependable leather seals. Special elastomer coating on *surface* of chrome re-tanned leather sealing lip prevents seepage of oil. Yet inner body of sealing lip retains natural porosity to "store" lubricant against accidental periods of starvation. Inherent lubricity of elastomer coating produces a lower torque, longer lasting, economical oil seal. Available in a wide variety of types and sizes.

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4824

CIRCLE 82 ON READER SERVICE CARD

COMPENSATED PUMP REDUCES HEAT

Concluded from page 96

vere operation with frequent stops and starts, and slow and fast table speeds.

In 24-hour continuous production runs using a constant delivery pump system, temperatures rose as much as 65 degrees above ambient temperature of 70 F.

Limiting the oil flow with a variable volume pump was a slight improvement over the constant volume system. During identical 24-hour tests, oil temperature beneath the table rose 35 degrees. This was still too much for close tolerance work.

When the same 24-hour tests were performed using the Hydra-Cool system, temperature rose only 3 degrees above ambient. Temperature on top of the table was nearly the same as temperature beneath the table.

MECHANICALLY ACTUATED SERVO VALVE

Concluded from page 92

a large-volume, low pressure-pump is used on larger machines.

Typical speeds and flow rates for a machine with 50,000-lb. force are: flashoff, 0.1 to 1 in. in from 1.3 to 60 sec with maximum corresponding flow rate of 0.7 gpm; typical upset speed of 500 ipm with a corresponding flow rate of 9 gpm. This machine uses a piston with an area of 41.2 sq. in. and operates at a little over 1200 psi. Since speed requirements during flashing are inversely proportional to machine size, the same servo valve is used for the entire line of machines.

Control of the flashing cycle is obtained with a follow or servo valve which meters fluid to the double-rod upset cylinder during that portion of the cycle. The valve is plunger actuated and is positioned by a mechanical linkage connected to a manual lever, a cam and cam follower, and to the platen cylinder, Figure 1. Operation may be manual, semi-automatic or fully automatic. This is one of the reasons for using this type of control. Other reasons are: it is simple and sturdy, and permits certain adjustments to be made without affecting other adjustments.

Shape of the acceleration curve during burnoff is a function of cam contour during the automatic and semi-automatic cycles. For manual operation, the cam has no effect. Actual speed of advance during burnoff is a function of the speed of cam rotation. Rotating speed is adjusted by a mechanical variable-speed drive.

• **Other Circuit Functions**—In addition to providing controlled acceleration for burnoff and high force for upsetting, the hydraulic system clamps the workpiece in position, Figure 2. Three-position, four-way valves, either manually or solenoid operated, control the clamp cylinders. A pressure reducing valve controls clamping force. Check valve in the pressure line to the clamp cylinders assures that there will be no relaxation of clamping force during the upset cycle. ▼▼▼

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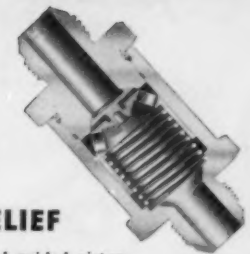

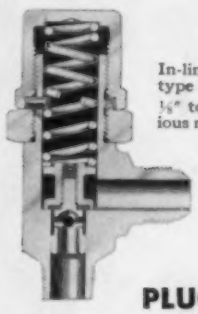

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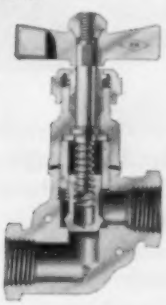

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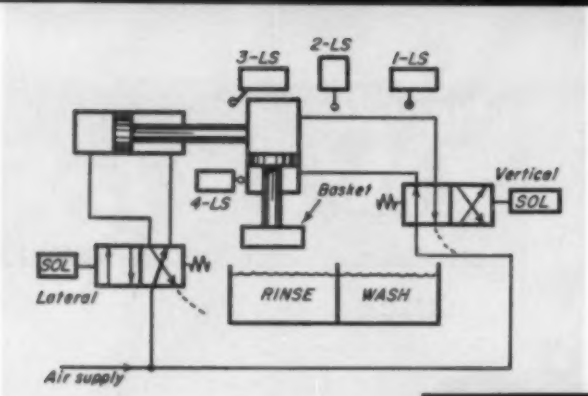
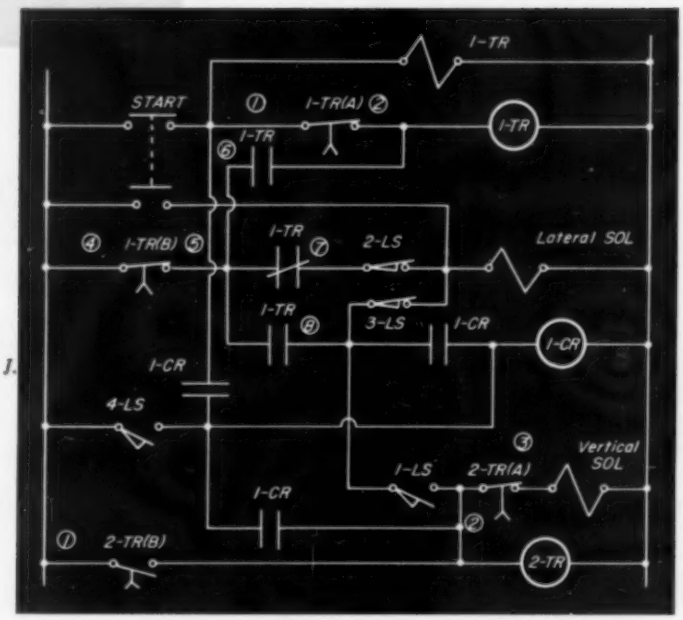


Timing an air circuit

• By M. G. Saake,
Ribble Engineering Co., Hackensack, N. J.



Do you know the many ways that synchronous motor timers can control fluid power circuits? For an exercise in understanding these versatile controls, go through this sequence for air-powered washing equipment which uses supersonic waves for cleaning. Reading time 12 minutes.

• **Transfer to wash tank**—All components are shown deactuated in the diagrams. Pressing START button energizes timer 1-TR and the LATERAL solenoid. Contacts of timer 1-TR are actuated, except 1-TR(A) and 1-TR(B) which remain in their normal position until the timer times out. They are then actuated and remain in this position until the timer is de-energized and reset. As the basket moves away from the rinse tank, limit switch 3-LS closes and energizes the LATERAL solenoid, so the START button can be released.

• **Washing**—When the basket is over the wash tank, limit switch 1-LS closes and energizes timer 2-TR. This timer alternately actuates and de-actuates its contacts as long as it is energized. This energizes and de-energizes the VERTICAL solenoid through contacts 2-TR(A), moving the basket into and out of the wash tank with timed periods in each position.

• **Transfer to rinse tank**—Washing action continues until timer 1-TR times out and resets. The LATERAL solenoid is kept energized through contacts 2-TR(B), 1-LS, and 3-LS until timer 2-TR completes its cycle, and the basket is completely out of the tank. Timer contacts 2-TR(B) and limit switch 2-LS then both open to de-energize the LATERAL solenoid and return the basket to its position over the rinse tank.

• **Rinsing**—When the basket is over the rinse tank, limit switch 4-LS is actuated to send a momentary impulse actuating relay 1-CR and both timers. The VERTICAL solenoid is energized through contacts of relay 1-CR and timer 2-TR, so that the basket moves in and out of the rinse tank.

• **Cycle stop**—Reciprocation continues until timer 1-TR times out and resets. The VERTICAL solenoid is then de-energized, and the basket rises out of the tank. If contacts 2-TR(B) are closed, timer 2-TR continues to run until its contacts are actuated, ready for the next washing cycle.

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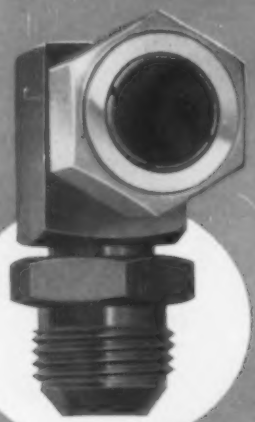

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Cylinder-operated controls acceleration

• By Lewis B. Lloyd, *Memphis, Tenn.*

TO PROTECT the banks of the lower Mississippi River, the U. S. Army Corps of Engineers places articulated concrete mats at points of erosion. Each mat is 20 concrete blocks held together by copper-clad steel wires. Overall size of a mat is 4 by 25 ft. Weight is 3300 lb.

The mats used to be hand-cast on a field more than a mile long by a force of from 80 to 100 men. Now, 25 men in a plant in Greenville, Miss. make 80 mats per hour. Casting the mats is completely automatic. The only manual labor is placing and latch-

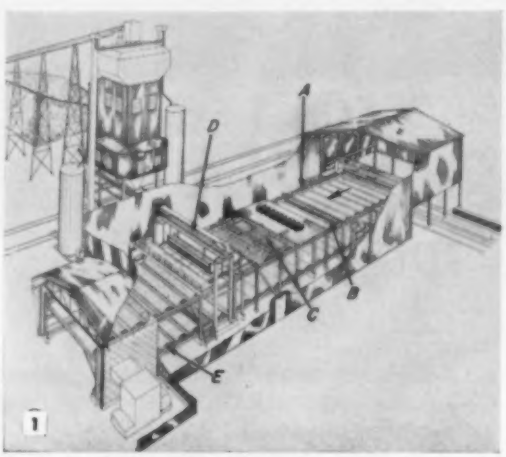


FIG. 1. IN THE AUTOMATIC MAT plant, dual endless-chain conveyor, *A*, carries pallets through pallet cleaner, *B*, and wire-placing station, *C*, to the casting station, *D*. At this point, cradle and pallet are unhooked from the conveyor and handled hydraulically until the mat is cast. Cradle is then hooked back on the conveyor and carried through a curing kiln, *E*.

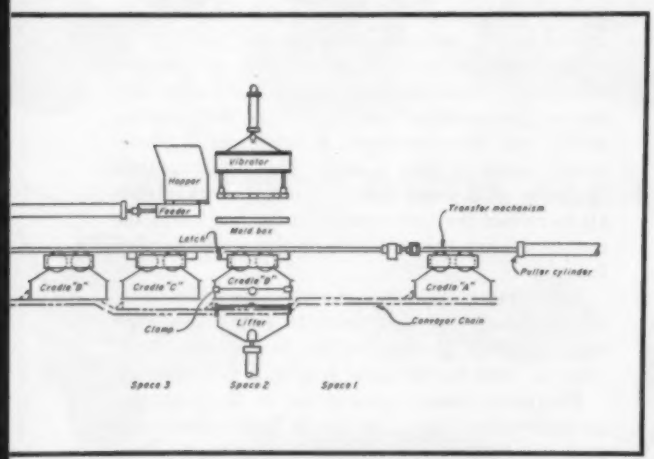
FIG. 2. AT THE CASTING STATION, two 2½-in. bore by 82-in. stroke hydraulic cylinders move one cradle into casting position (Space 2) and move the cradle on which a freshly made mat rests into space 1 where it reconnects to the conveyor. Cradle is then lifted by two 3¼-in. bore by 60-in. stroke cylinders to contact the bottom of the mold box. Feed box and hopper are then moved into position above the mold box. This is done with two 3¼-in. bore by 71-in. stroke cylinders. The stroke is completed in 4 sec.

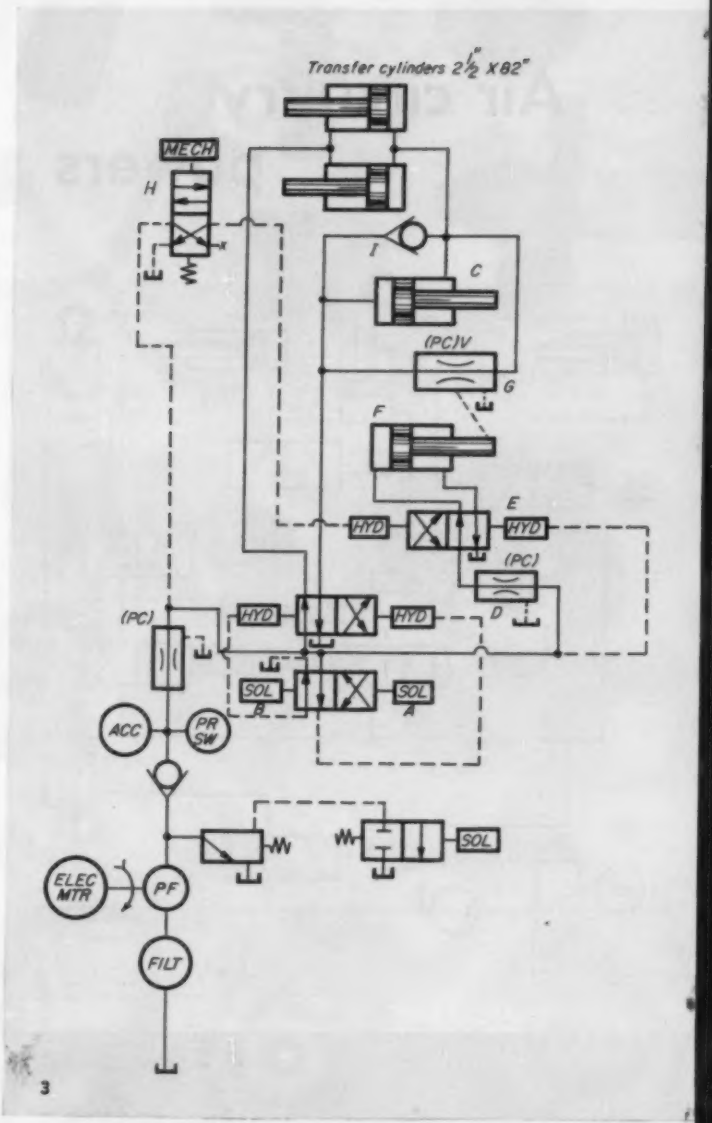
Feed box is then withdrawn, striking off the mat flush with the top of the mold box. As the

metering valve of heavy load

ing the reinforcing wire. The system's almost all hydraulic.

• **Hydraulic System**—Pallets on which the mats are cast are flat steel sheets, which move through the plant on an endless chain conveyor until they reach the casting station, Figure 1. Here, all handling is hydraulic, Figure 2. Circuit diagram for control of transfer cylinders is shown in Figure 3. This circuit and the method of controlling acceleration and deceleration of the cylinders is typical of the remainder of the hydraulic system. ▼▼▼





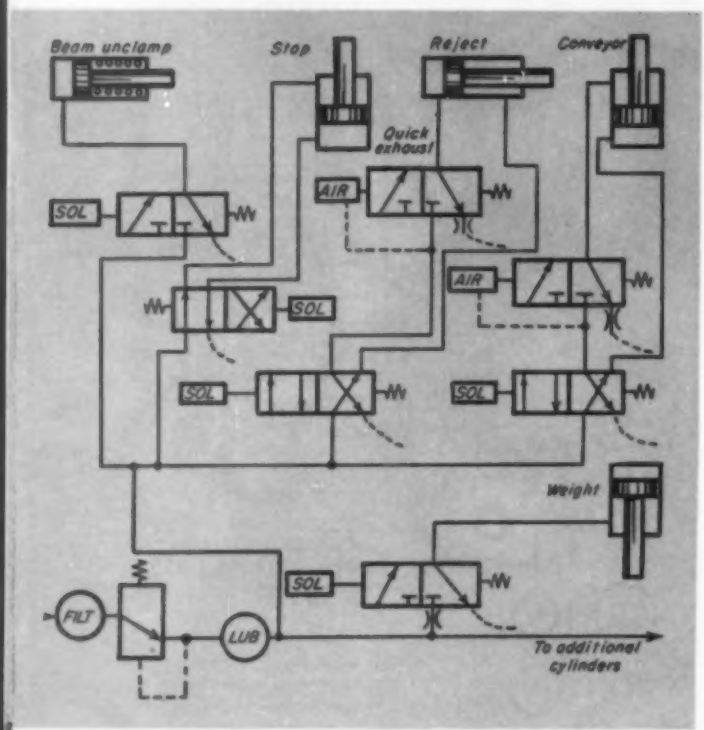
feed box clears the mold box, a timer is energized to start ten vibrators attached to the lifterhead. Full retraction of feed box cylinders initiates lowering of the vibrator head which is moved by two 3½-in. bore by 18-in. stroke cylinders. At the end of approximately 19 seconds of vibration to compact the mix, vibrator head is lifted away from the mat and lifterhead lowers mat and pallet to transfer position.

FIG. 3, HYDRAULIC CIRCUIT DIAGRAM of mat transfer mechanism. This circuit extends the two 2½-in bore by 82-in. stroke cylinders in 6 sec. This is the program: (1) 3-in. rapid advance in 0.15 sec; (2) 67-in. controlled advance in 4.8 sec; (3) decelerate 12 in. in 1.05 sec; (4) stop. This requires 640 cu. in. at a rate of 27.7 gpm which is supplied by a 36-gpm vane pump.

When a limit switch operated by the conveyor chain energizes SOL *B*, the four-way, solenoid-pilot valve directs oil to rod ends of the transfer cylinders. First 3 in. of travel is rapid as oil from head ends of cylinders fills metering cylinder, *C*. At the same time, flow through flow-control valve *D* and four-way valve *E* into cylinder *F* moves the piston of *F* to the right and slowly opens flow-control valve *G* by a lever attached to the control dial. This opening time controls cylinder acceleration. A mechanical stop is used to limit valve opening to a point giving cylinder speed of 1.5 fps.

When the cylinder is 1 ft. from the end of its stroke, pilot valve *H* is tripped by a dog. This applies pressure to the left end of four-way valve *E* which reverses motion of cylinder *F* to close the flow-control valve. Closing flow-control valve *G* brings the two transfer cylinders to a gradual stop. At the end of the stroke, a limit switch drops out SOL *B* and energizes SOL *A*. This applies oil to the head ends of the transfer cylinders through check valve *I* for rapid return. Metering cylinder *C* resets during return because of the difference in rod-end and head-end areas.

Air circuitry powers automatic weighing



• By Arthur A. Fischer, *Plant Superintendent Thayer Scale Corp., Pembroke, Mass.*

and Russ Springer, *Sales Engineer, Knox, Inc., East Walpole, Mass.*

SMALL air cylinders perform the operations on a compact, check weighing scale built by Thayer Scale Corp. In addition to controlling flow of material on and off the scale, the air system also permits quick remote selection of a standard weight against which the material is checked.

The scale is installed in-line with a conveyor transporting cartons to be weighed, and has its own electric motor-driven conveyor. As each carton moves onto this conveyor, it interrupts a photo-electric beam to start a timer. This timer controls operation of a 4-way solenoid valve which directs air to retract the CONVEYOR cylinder and lower the conveyor when the carton is on the weighing platform.

Interrupting the photo-electric beam also actuates a second solenoid valve to extend the STOP cylinder which places a barrier in the conveyor to stop the next carton until weighing is completed.

Electrical contacts sense either an overweight or an underweight when the weigh beam moves to a high or low adjustable tolerance contact. When either of these contacts is made, the CONVEYOR cylinder remains retracted and the solenoid valve controlling the REJECT cylinder is actuated to discharge the carton at right angles to the conveyor.

If the electrical contacts are not made after a timed period (carton weight within limits) the CONVEYOR cylinder raises and the carton moves off on the main conveyor. The weigh beam is mechani-

AIR CIRCUIT shows only one of 10 WEIGHT cylinders which lift weights as selected for checking cartons up to 40 lb. Flow control at valve inlet prevents fast acting cylinder from damaging sensitive scale.

WEIGHING takes place with conveyor lowered as shown.

CIRCLE 97 →

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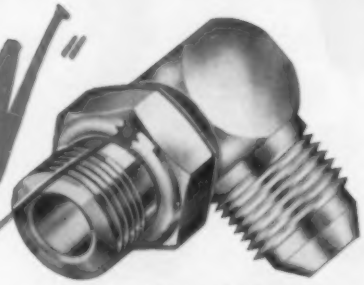

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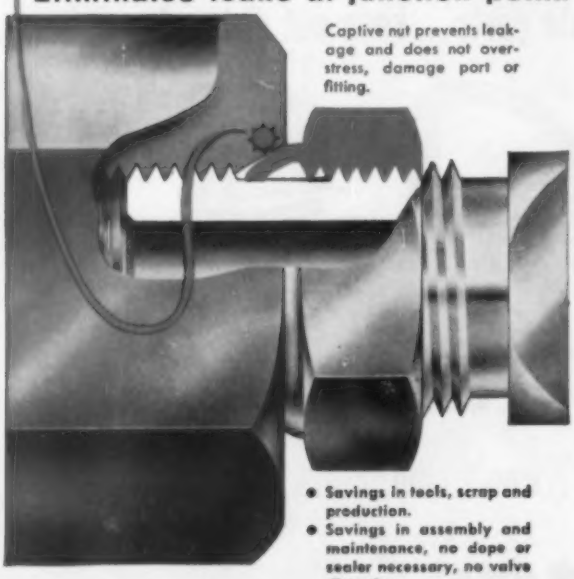

- Savings in tools, scrap and production.
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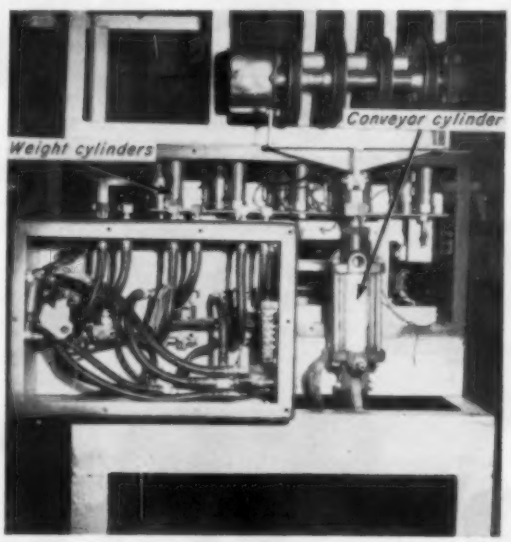
AIR CIRCUITRY POWERS AUTOMATIC WEIGHING

cally clamped between weighings and is unclamped by a 1-inch bore, spring-loaded cylinder.

● **Pre-selector**—The scale is designed to handle a weight of 40 lb, and nominal carton weights other than this are weighed by using a pre-selector system. Ten 1⅛-inch bore cylinders are mounted with their rod ends down and attached to weights. When the cylinders are retracted, they pick up the weight which adds to the weight of the carton being checked. These weights range from 8 to 32 lb and are selected by pushbuttons marked directly in weight to be checked. The pushbuttons actuate solenoid valves which direct air to retract the cylinders. If a 10-lb carton is to be checked, a 30-lb weight is picked up by the cylinders. For other cartons, necessary weight is picked up to total 40 lb.

To prevent jarring of the sensitive weigh beam as the weights are picked up, flow control valves are connected to the inlets of the 3-way valves controlling the WEIGHT cylinders.



CONVEYOR cylinder raises and lowers conveyor. Dust-proof enclosure protects 4-way valves and air lines, and can be pressurized in very dusty atmospheres.

For fast action of the REJECT cylinder and the CONVEYOR cylinder, quick exhaust valves are installed at the cylinder ports. These valves have an internal diaphragm which controls the 3-way action. When air pressure is applied at the inlet port, the diaphragm is flexed to open the cylinder port and close the exhaust port. When the inlet is vented to atmosphere, pressure in the cylinder flexes the diaphragm to exhaust the cylinder directly to atmosphere without going through piping. This prevents any back-pressure from building up because of air flow through the piping. ▼▼▼

AVIATION SECTION

Applied Hydraulics

MAY 1958

BEARINGS FOR AIRCRAFT HYDRAULIC PUMPS 108

By W. S. Bobier, Jr. and C. R. Potter

Bearing size and weight are affected by operating speeds and pressures. Optimum values of speed and pressure are found. Type selection is also covered.

HYDRAULIC CYLINDERS SIMULATE AIR LOADING 112

Hull tests on the Boeing KC-135 are conducted underwater to safely simulate cabin pressurization and air loading. Nineteen hydraulic cylinders control rates of motion and twisting during simulated flights.

AVIATION NEWS FROM THE FLUID POWER FIELD 115

AVIATION COMPONENT DATA 117

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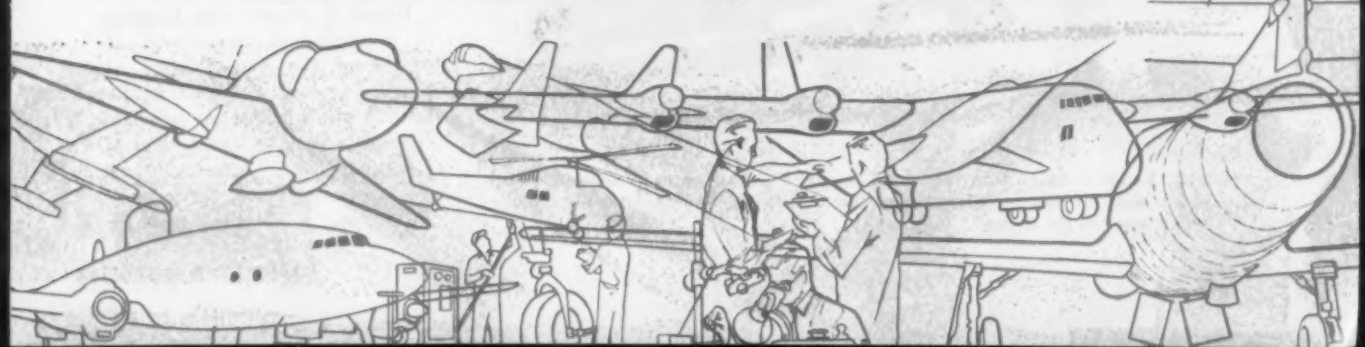


Bearings for aircraft hydraulic pumps

- SPEED AND PRESSURE EFFECTS
- TYPE SELECTION PROCEDURE

• By W. S. Bobier, Jr., *Chief Engineer, Detroit Section*
and C. R. Potter, *Project Engineer,*
Aero Hydraulics Div., Vickers Inc., Detroit

AIRCRAFT hydraulic circuit designers want small size, low weight, reliability and high efficiency. Because the pump is the heart of the hydraulic system and usually the heaviest part, careful pump design is the first step toward the wanted system.

Pump bearing weight is a big portion of total pump weight. Bearings take up a lot of room in a pump, Figure 1. It follows that careful bearing selection is essential to good pump design.

Purpose of bearings in a pump is to hold the rotating parts in the right places and to keep low the friction losses that go with rotation. Because speeds and loads are high, and because hydraulic fluids which lubricate the bearings have very low viscosities at the high temperatures met in modern aircraft, ball and roller, or antifriction, bearings are almost always used. Other types are sometimes used to save weight. The saving, however, is small and the loss in mechanical efficiency is large.

• **Speed and Pressure Effects** —Horsepower delivered by a pump is proportional to the pressure multiplied by flow rate, and flow rate is almost directly proportional to the rotating speed of the pump. Therefore, to get the most horsepower from a pump, operating speeds and pressures should be high. But, high speeds and pressures increase bearing loads and wear. So, if pump output is to be increased by increasing pressure and speed, bearing size and weight must go up. If the bearings are larger, the housing will be larger and heavier.

Since the best pump is the one that gives the most horsepower per pound of weight, the question to be answered now is: Which increases faster as speed and pressure are increased, horsepower or weight?

Figure 2 shows what happens when pressure is increased and bearing size and weight are also increased to maintain a constant minimum life. Minimum life for military pumps is 750 hours; for commercial units, 2000 hours. All the curves peak between 3000 and 3500 psi. Although these curves are based on certain axial piston pumps, the same sort of thing happens with other designs.

To complete the picture of pressure versus horsepower per pound, it must be admitted that overall system weight might be less at some higher or lower pressure. This can only be found by analyzing specific, complete systems. Where system horsepower per unit weight peaks, would depend on what happened to weights of hoses, tubes, valves, etc.

Figure 3 shows what happens to horsepower per pound of weight of the same types of pumps as rpm is increased. Again, bearing size and weight were increased to keep minimum lives of 750 and 2000 hours. Although this analysis was not carried past 6500 rpm, it appears that the

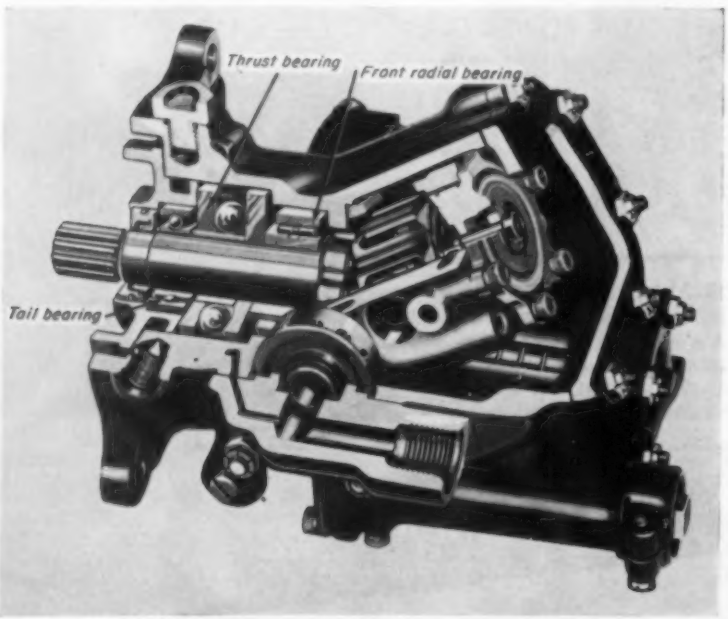


FIG. 1. THIS CUTAWAY VIEW of an axial piston pump for aircraft use shows that the two radial bearings and the thrust bearing take up quite a bit of space in the pump.

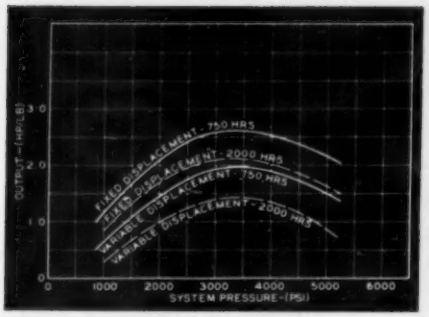

FIXED DISPLACEMENT - 750 HRS
FIXED DISPLACEMENT - 2000 HRS
VARIABLE DISPLACEMENT - 750 HRS
VARIABLE DISPLACEMENT - 2000 HRS
OUTPUT - (HP/LB)
SYSTEM PRESSURE - (PSI)

FIG. 2. BECAUSE BEARING WEIGHT must increase as pressure increases maximum horsepower per pound of pump weight is obtained at a pressure of about 3500 psi.

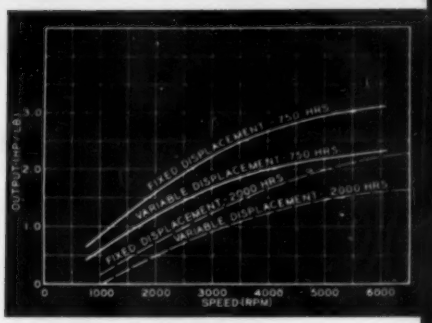

FIXED DISPLACEMENT - 750 HRS
VARIABLE DISPLACEMENT - 2000 HRS
FIXED DISPLACEMENT - 2000 HRS
VARIABLE DISPLACEMENT - 2000 HRS
OUTPUT - (HP/LB)
SPEED (RPM)

FIG. 3. HORSEPOWER PER POUND plotted against speed shows that 7500 to 8000 rpm is about optimum.

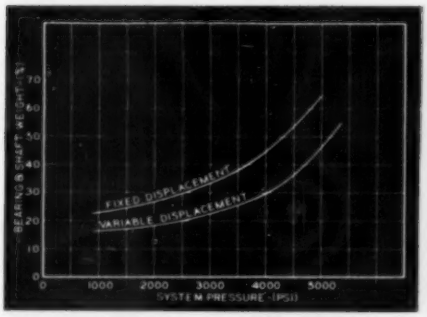


FIG. 4. EFFECT OF PRESSURE on bearing and shaft weight expressed as a percentage of total pump weight.

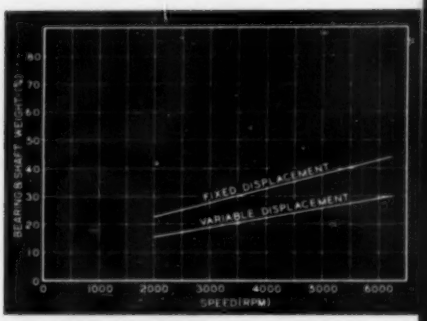


FIG. 5. BEARING AND SHAFT weight as a percentage of total pump weight for various speeds.

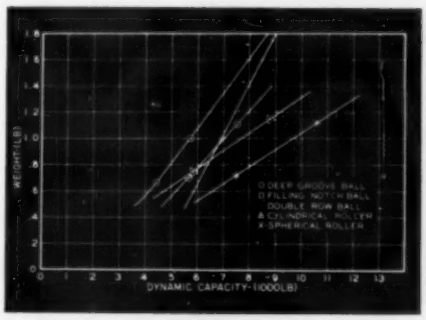


FIG. 6. RADIAL BEARING LOAD capacity versus weight.

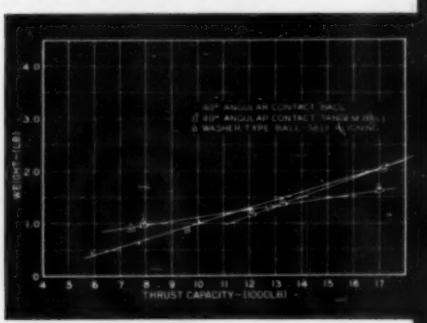


FIG. 7. THRUST BEARING LOAD capacity versus weight.

curves will peak at 7500 to 8000 rpm.

The conclusion reached is that there is much more to be gained by raising pump speeds above those now used than by increasing pressure. The reason for this is that bearing life varies as the cube of the load and linearly with speed. In other words, doubling the load would reduce life eight times; while doubling speed would only cut life in half. How these factors affect weight of bearings and shaft as a percentage of total pump weight is shown by Figures 4 and 5.

• **Bearing Selection**—Before any attempt is made to select the proper bearing type from those available, there are some pertinent bits of information which should be listed. These are:

1. Minimun possible shaft size
2. Maximum opening in the housing for bearing OD
3. Maximum rotating speed
4. Maximum operating temperature
5. Maximum load due to hydraulic pressure and other causes
6. Load cycle

Now, forget all the figures for a moment and decide that standard bearings should be used whenever possible because they cost less and delivery is quicker than for special bearings. Another general point to remember is that high-precision bearings, which cannot tolerate the slightest misalignment should not be used. Bearings with regular commercial tolerances are better.

Next step is to select the lightest bearing which fulfills the other requirements. Figures 6 and 7 show weight and capacity characteristics of some of the commonly-used types of radial and thrust bearings. The characteristic lines were constructed by using capacities of 35-mm bore, light and medium series bearings. Dimensions of all the light series are the same, as are those of the medium series with the exception of the double-row bearings which are wider.

When weight per unit of capacity is nearly the same for two or more types, selection is based on relative cost or other factors. Table 1 shows relative cost of the bearings.

One thing not indicated by weight-capacity curves is the range of sizes available. For instance, spherical roller bearings are not made with bores smaller than 30 mm. Therefore, the curves here are intended as an example. New curves should be constructed for any bore size other than 35 mm.

There is one type of radial bearing which has not been mentioned but should be considered when speed N is less than $100{,}000/D$; where D is the bore in mm. This is the full-complement cylindrical roller bearing which has high capacity but is limited to the low speeds because of rubbing contact between rollers.

Bearing speeds should general-

ly be limited to 250,000 divided by the bore diameter in millimeters, or speed $N = 250{,}000/D$. This is not true of the plain ball thrust bearing. Here, allowable speed increases with the thrust load to a limit of $200{,}000/D$. This is because centrifugal force tends to throw the balls out of the races. Centrifugal force must be calculated and compared with thrust forces for these bearings.

Thrust bearing speed may be increased by building a contact angle into the races, Figure 8. Again, calculation is necessary to find out if the balls will stay in the races. The cage should not be depended on to take any of the centrifugal load.

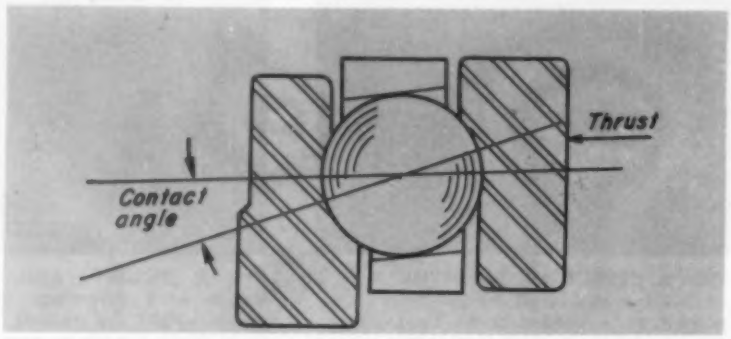
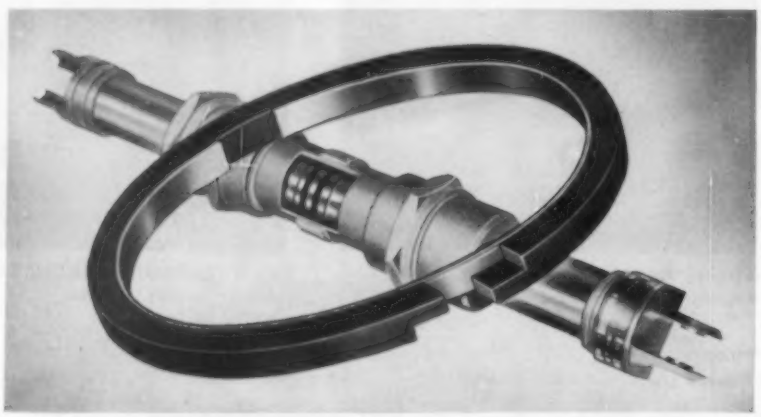


FIG. 8. THRUST BEARING LOAD CAPACITY is increased by using angular races as shown here.

• **Materials**—Bearing material selection is up to the bearing manufacturer. But, when a pump is being designed for high-temperature use, be sure the manufacturer knows it. Commonly used bearing materials are good to only 375 F. With fluid temperatures of 550 F, the bearing may stabilize at 650 F. Manufacturers can supply bearings for temperatures over 400 F when they know they're needed. ▼▼▼

Table I—Relative Bearing Cost

BEARING TYPE	RELATIVE COST (%)
Deep-Groove Radial	100
Double-Row Radial	310
Cylindrical-Roller Radial	720
Barrel-Roller Radial	800
Angular Contact Thrust	180
Washer Thrust	700
Tandem Angular-Contact Thrust	790



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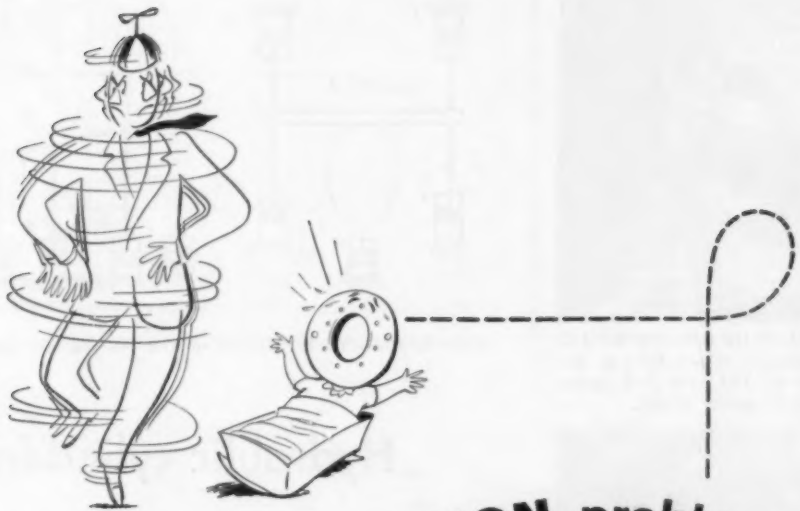

a FRETTING-CORROSION problem had him in a spin

Finding a wear-resistant coating for turbine engine shaft seals posed a serious problem for an aircraft engine manufacturer. Even the hardest alloys were subject to fretting corrosion and had to be replaced after a few hours of service.

This fretting-corrosion problem was solved by having the bearing surface of the seal Flame-Plated by LINDE. By this special detonation process, particles of tungsten carbide are literally *blasted* onto almost any metal surface. Most important, the temperature of the part being plated never exceeds 400° F., so there is little chance that the base metal will warp or that its metallurgical properties will be changed. Flame-Plated tungsten carbide coatings can be applied in thicknesses from .010 to .002 inches. Coatings can be used in the as-coated condition (125 microinches rms) or ground and lapped to a 0.5 microinch finish.

If your design involves metal parts subject to extreme wear, heat, or fretting corrosion, perhaps Flame-Plating can eliminate some or all of your "headaches"—or make possible some completely new idea.

To find out, write us about your wear problem or request a free copy of LINDE's booklet, "Flame-Plating," F8065. Address Flame-Plating Department.

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FUSELAGE OF BOEING KC-135 flying tanker is shown here in the 20 by 20 by 135 foot hydrostatic testing tank, partly filled.

FIG. 2. HYDRAULIC CYLINDERS are under water during testing. Workmen are installing one here.

FIG. 4. PANEL OF PRESSURE GAGES, pressure reducing regulators and accumulators. 85 Servo pilot valves, are on another panel.

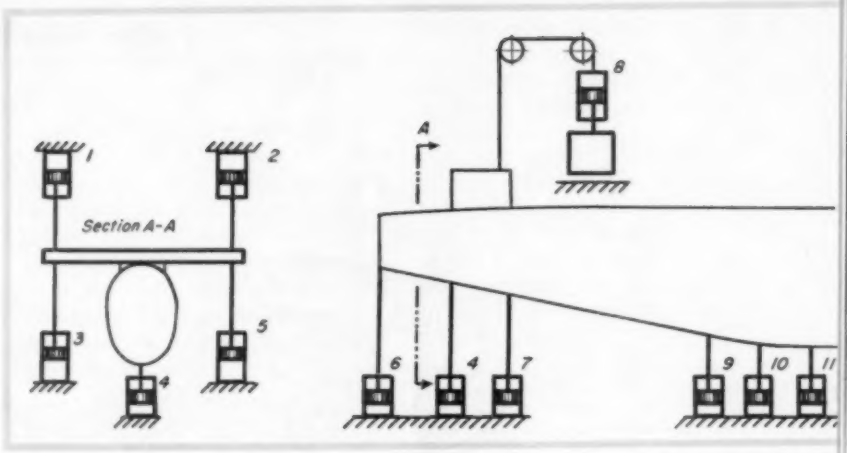


FIG. 1. FLIGHT LOADING of the fuselage is simulated by hydraulic-cylinder-

Hydraulic cylinders simulate air

A BOEING KC-135 jet transport-tanker is flying in a tank of water to find out how long the fuselage can go without a major overhaul. Typical flight conditions, such as takeoff, cabin pressurization, fin loads, wind gusts and landing loads can be simulated. The tank test, in 5 minutes, does to the fuselage everything that might be expected in a 5-hr flight.

Inside the fuselage, water under pressure simulates cabin pressurization. Nineteen hydraulic cylinders rock and roll the hull, Figure 1.

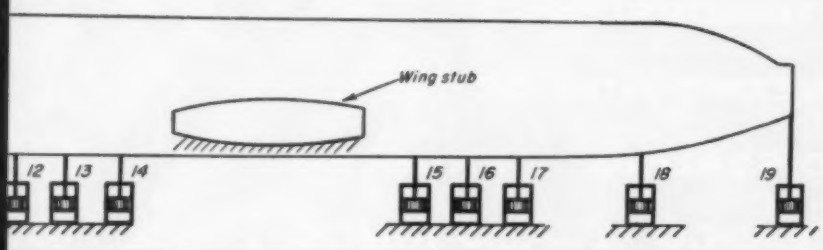
All the cylinders are single acting; restoring forces come from buoyancy of the hull. Air tanks inside the hull provide this buoyancy. However, the rate of movement upward is controlled by the rate at which oil is metered from the cylinders. All but three of the cylinders are under water during the test, Figure 2.

• **Hydraulic Circuit**—For simplicity's sake, only a part of the hydraulic circuit is shown in Figure 3. The part shown controls speed of one of the cylinders during low gust loading simulation. There are similar circuits for medium gusts, high gusts, ground loads, shut down loads and torsion loads.

All cylinders and valves are supplied with oil by a 35-gpm pump and 13-gal accumulator. The manual Program Selector directs oil either to a manual or to a cam-operated Low Gust valve to automatically apply load during a controlled cycle. A manual Shutoff Pilot works shutoff valves in the lines from all automatic program valves.

The Low Gust valve shifts the Servo Pilot valve to apply one or the other of two preset pressures to the servo valve piston. Flow in or out of the loading cylinder is proportional to the pressure applied to the servo valve. In the complete circuit, the low gust selector operates 17 servo pilots to control motion of 19 cylinders (cylinders 1 and 5, and cylinders 2 and 3 work in pairs). There are 17 servo pilot valves for each of the other flight conditions, a total of 85.

Although this circuit is elaborate, the number of lines and



controlled motion. Automatic or manual valves select flight load conditions.

Why Test It In A Tank?

By testing an aircraft fuselage in a tank of water, the inside can be pressurized with water. This speeds up testing and does away with any chance of an explosion if the structure should fail. If the fuselage were simply filled with water while on dry land, the tremendous weight of water inside would far exceed the design load of the structure. This weight is easily counterbalanced by submerging the whole thing in a tank of water.

Rate of movement need not be as high in water to produce the same forces on the fuselage that air would.

loading of KC-135

valves carrying working flow is a minimum. Since the job of the servo valves is to regulate flow in or out of the loading cylinders, one might ask whether flow control valves could simplify the circuit. The answer is that each cylinder requires from 3 to 8 different flow rates, and the number of flow control valves needed would be large. In addition, some, if not all of the flow controls would have to carry quite high flow.

The different pressures are supplied to the servo pilot valves by 36 pressure-reducing regulators mounted on a panel with 36 pressure gages and 36 one-gallon accumulators, Figure 4. Some of the regulated pressures are used to position more than one servo valve at the same time. For example, one pressure is used to position four of the servo valves during movement in one direction for low gust simulation. ▼▼▼

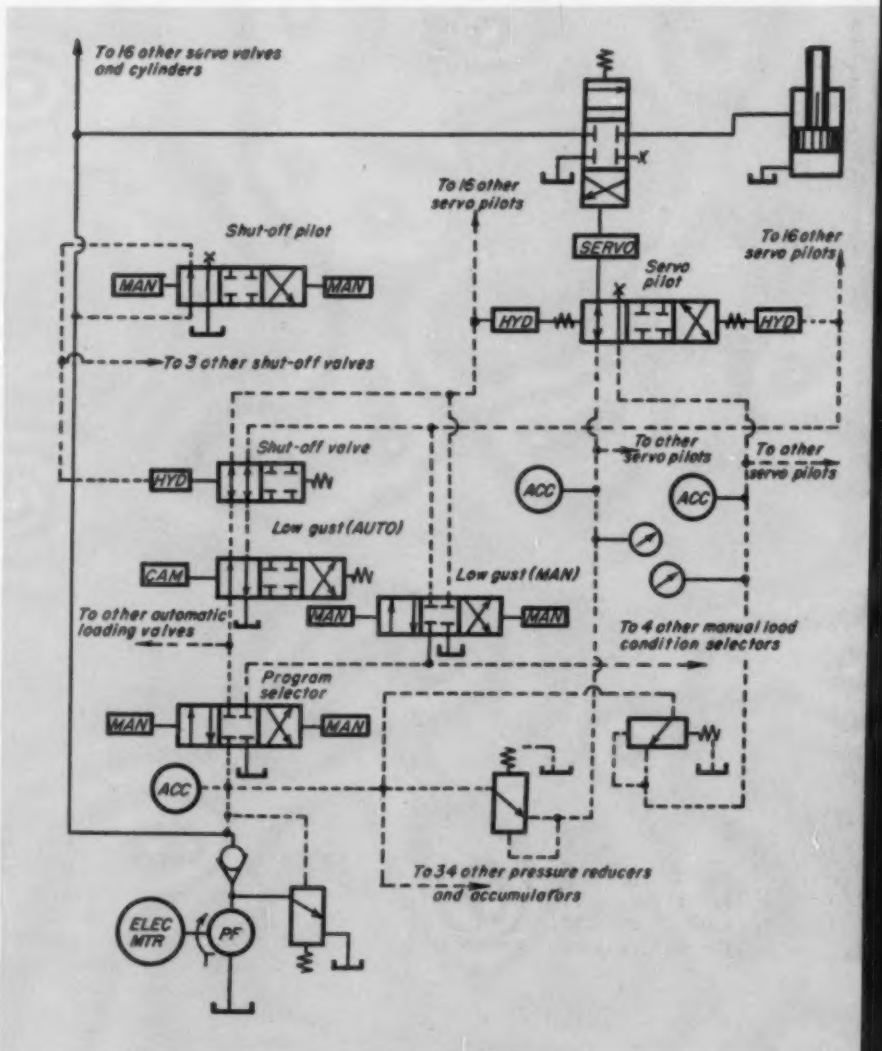


FIG. 3. PARTIAL CIRCUIT DIAGRAM of the hydraulic system. More than 8000 ft. of hydraulic tubing is used.

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AVIATION NEWS

from the fluid power field

E. Gravenhorst
Waldorf Instrument Co.

Gordon J. Wygant
Titeflex Inc.

T. Nugent
United Aircraft Products

Everett Gravenhorst has been named director of engineering, Fluid Systems Div., **Waldorf Instrument Co.** Before joining Waldorf, Gravenhorst was chief mechanical engineer of The Martin Co. For a number of years, he was supervisor of hydraulic design at Air Associates.

Titeflex Inc. has appointed **Gordon J. Wygant** aviation sales manager. Wygant has been with Titeflex since 1941 in various capacities including chief engineer in charge of development of Teflon hose and director of market research and sales planning.

Thomas Nugent was appointed sales representative for **United Aircraft Products Inc.** Nugent's activities will be concentrated in the west coast area where he will work out of the firm's Contractual Engineering Office in Burbank, Calif.

New York—Sperry Gyroscope Co. has announced a new jet engine control development laboratory on Long Island. Among the test facilities installed is a hydraulics test lab for component and system testing. Components can be tested at temperatures greater than 2000 F. Large, complete systems can be tested at 800 F. Other extremes in atmospheric and operating conditions can also be reproduced. Complete instrumentation gives flow, temperature and pressure data.

BIG AIRFRAMES . . .

. . . need big hydraulic machine tools. This "Hydro-Tel" tracer controlled machine is used to mill parts for the Martin P6M SeaMaster. Tracer control has .0005 in. tolerance. Hydraulic speed controls give 1 to 25 ipm for tracer cuts and up to 50 ipm for straight milling cuts. Rapid traverse is 120 ipm.

Detroit—"Aero Trends", a quarterly publication containing field suggestions, service hints, and engineering changes in Vickers aircraft hydraulic equipment was first published at the beginning of this year. It replaces the Product Service Information Letter previously distributed by Vickers.

Koehler Aircraft Products Co. announced the appointment of **Robert J. Hostetter** as sales manager. Formerly sales manager of National Water Lift Co., Hostetter has also served with AiResearch Mfg. Co., Douglas Aircraft Co. and Cook Electric Co. His headquarters will be in Dayton.

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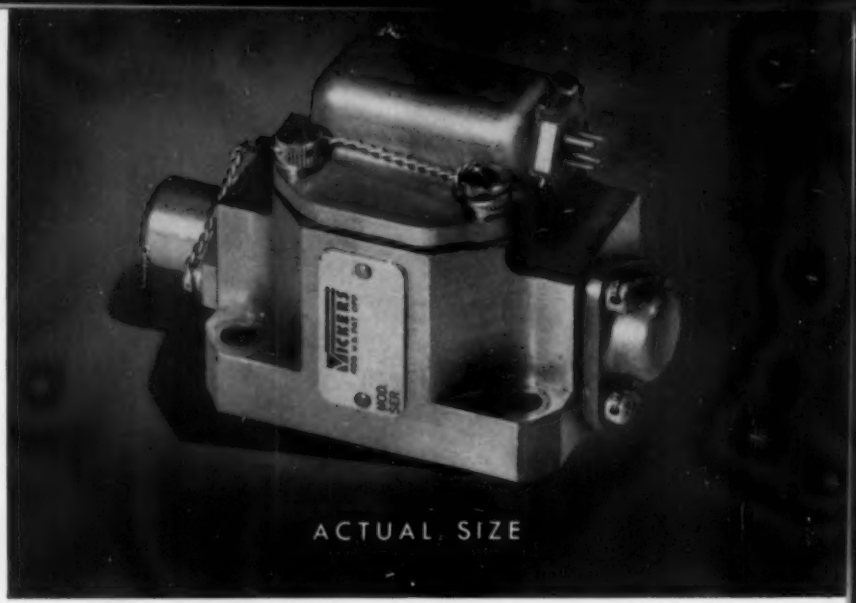
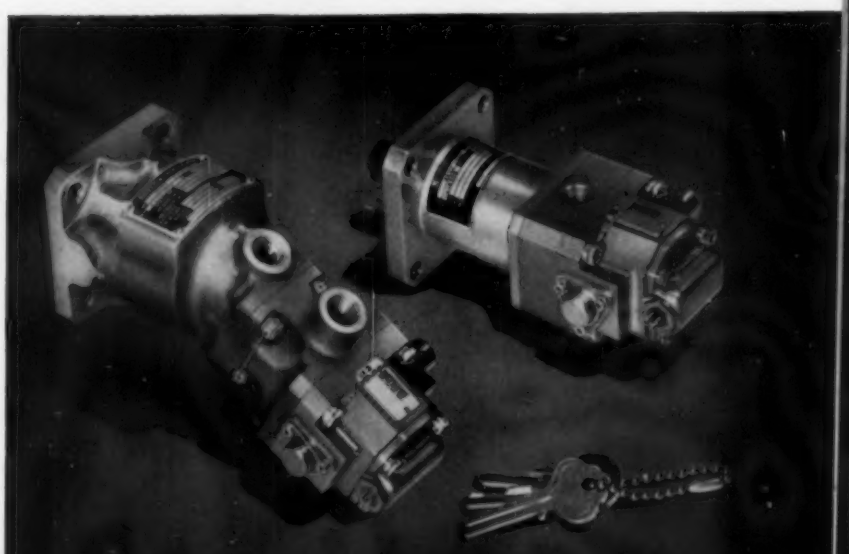


New VICKERS SERVO VALVE

Designed primarily for aircraft and missile applications, the new Vickers Electro-Hydraulic Servo Valve has numerous features (see above) that assure optimum performance and dependability.

Porting modulated flow to linear or rotary actuators with respect to minute input current has been optimized within a small envelope and at a weight that is approximately 30% less than other valves of similar capacity. Design also provides for interchangeability with many existing servo valves now used in airborne applications. For further information, ask for technical bulletin number SE-98.



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Inline Relief Valves
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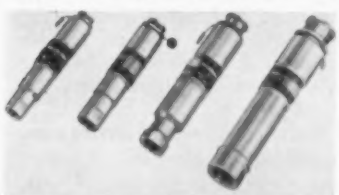
These valves conform to MS 28887 envelope specifications and meet or exceed MIL-V-5523B and the proposed "C" revision Type II specifications (reverse flow excepted). A special compensating



design feature allows flow rates to be as high as 4.5 times MIL-V-5523B rated flow without exceeding the allowable pressure differential. Light and compact, the valves are fully qualified for —65 to 275 F. Maximum pressure adjustments range from 50 to 4850 psi. Port sizes are ¼, ⅜ and ½ in.—*Bendix Pacific Div., N. Hollywood, Calif.*

CIRCLE 500 ON READER SERVICE CARD

Pressure Transducers
. . . for precise measurement

Glennite PSG-1 series pressure transducers are constructed of Monel and have a type 416 stainless steel cavity. They can be used with any fluid or gas noncorrosive

to this type of stainless. Types available are for measuring absolute, gage or differential pressures. Operating temperature range is —100 to 300 F. Unbonded strain gage element is connected in a four-arm bridge around a six sided diaphragm. Deflection of the diaphragm unbalances the bridge and produces a change in electrical resistance proportional to pressure. Output can be to standard recording, indicating or telemetering instruments. Units are insensitive to vibration and acceleration. Shift due to temperature change is low.—*Gulton Industries Inc., Metuchen, N. J.*

CIRCLE 501 ON READER SERVICE CARD

Ground Service Cart
. . . gives 3300 psi air

Air supplied by this lightweight, portable cart may be used to charge aircraft and missile bottles, service

landing gear shock struts and tires, and for starting. Measuring 40-¾ by 22-⅞ by 22-¾ in. with the handle retracted, the cart weighs 152 lb with a gasoline engine or 140 lb with an electric motor compressor drive. The 4 scfm compressor will operate at —40 to 125 F. Fiberglass or metal wound storage container holds 1300 cu in. Moisture separator and chemical dryer reduce air dewpoint to —65 F.—*Walter Kidde & Co. Inc., Belleville, N. J.*

CIRCLE 502 ON READER SERVICE CARD

Power Packs
. . . for missiles

Model E/HS 105, Type 200, (illustrated) hydraulic power pack is made up of an electric drive

motor, hydraulic pump, reservoir, and relief valve. The unit supplies 0.53 gpm of MIL-O-5606 over a range of —65 to 275 F. Input power is 400 w, 115-v, 3-phase, 400-cycle ac. Weight is 4 lb, 12 oz; dimensions are 7-¾ by 2-½ by 7-½ in. On one application, this unit is feeding four actuators in a servomechanism driving a radar antenna.

Model EHS 5, Type 100 A was developed to furnish oil to elevons and wing folding actuators in a small missile. This unit delivers 0.4 gpm of OS-45 at 750 psi. Input is 300 w, 208-v, 3-phase, 400-cycle ac. Weight is 5 lb, 4 oz; envelope dimensions are 8-⅛ by 4-⅜ by 4-⅛ in.—*Eastern Industries Inc., Hamden, Conn.*

CIRCLE 503 ON READER SERVICE CARD

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. . . has low pour point

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Continued on next page

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TYPE: Three-Way, Two-Position
FLUID: MIL-O-5606 Hydraulic Oil
PRESSURE: 3000 PSI
TEMP. RANGE: −65°F to +275°F
PRESSURE DROP: 80 PSI at 2.3 GPM and 70°F
PORTS: Three, per AND 10050-4
SOLENOID: 14 to 29 Volt DC
CURRENT DRAIN: 1.6 Amps at 29 Volt DC and 70°F
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1132 Donson Drive, Dayton 10, Ohio

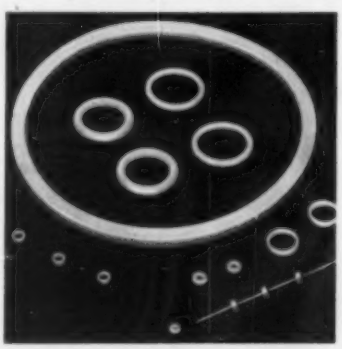
AVIATION COMPONENT DATA

most methyl silicone fluids. Low viscosity gives faster response than fluids of higher viscosity in servomechanisms and other control devices. Like other silicone fluids, 81743 resists shear and has unusual chemical resistance. Flash points for the 5, 10, and 20 centistoke grades are 310, 415, and 525 F respectively. Pour points in the same order are −100, −100, and −76 F.—*Silicone Products Dept., General Electric Co., Waterford, N. Y.*

CIRCLE 504 ON READER SERVICE CARD

Teflon Seal Rings
. . . to close tolerances

Dimensional tolerances of 0.001 in. or less can be maintained in Oh and V-rings produced from a special high-density Teflon rod called



TSI. Square, round or oval cross-sections from 3/ 32 to 15/16-in. OD. are made. The special stock improves mechanical, thermal and chemical properties of the seals. Some have been used at 30,000 psi and temperatures of −200 to 425 F without failure.—*Tri-Point Plastics Inc., Albertson, L. I., N. Y.*

CIRCLE 505 ON READER SERVICE CARD

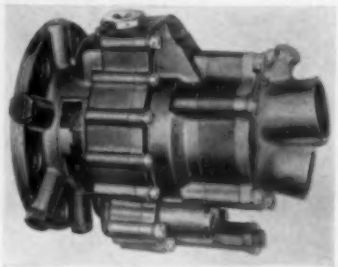
Pneumatic Selector Valve

. . . for operating pressures to 3000 psi is fully described in Data Sheet 9081. Two-color, single-page sheet includes specifications, dimensional drawings and schematic diagrams.—*Tactair Valve Div., Aircraft Products Co., Bridgeport, Pa.*

CIRCLE 506 ON READER SERVICE CARD

Hydraulic Pump
. . . for low inlet pressure

AP6V series pump weighs 14.5 lb, develops 3000 psi, and has 16 gpm output. Two-stage design lets the pump operate efficiently at much lower inlet pressure than many others. The pressure compensator is extremely fast; the



pump will shift from zero to maximum delivery in 20 to 30 millisec—about twice the speed required by military specifications. Fully qualified and tested, these pumps are now being used on the McDonnell F-101 Voodoo.—*Kellogg Div., American Brake Shoe Co., Rochester, N. Y.*

CIRCLE 507 ON READER SERVICE CARD

Miniature Pressure Gage
. . . weighs 0.084 lb

Developed for the Nike Hercules, this gage has OD of 1.72 in.; depth is 0.90 in. The unit threads directly into the accumulator manifold and reads from 0 to 4000 psi. Small size and weight result from use of a helical bourdon tube that connects directly to the pointer. Special rear fitting lets the gage be turned to any position and still be tightly sealed.—*Glassco Instrument Co., Pasadena, Calif.*

CIRCLE 508 ON READER SERVICE CARD

Gas Booster
. . . for 10,000 psi

For use with nitrogen or helium, this two-stage gas booster may be used for laboratory or production testing, as well as flight line checkout of aircraft and missile systems. Output pressures of 6,000 to 10,000 psi are automatically maintained. The unit has high-pressure storage bottles. Up to 90% recovery of gas is possible. Low gas temperatures are maintained by intercoolers and aftercoolers.—*The Rucker Co., San Pablo, Oakland, Calif.*

CIRCLE 509 ON READER SERVICE CARD

Rubber Compounds

. . . for use with the new high-temperature hydraulic fluids are described in Engineering Bulletins 708 and 716. Original physical properties and properties after use with various fluids at high and low temperatures are listed.—*Precision Rubber Products Corp., Dayton, O.*

CIRCLE 510 ON READER SERVICE CARD

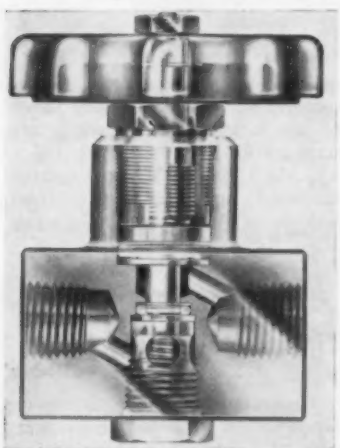
Hydraulic Test Stand
. . . for low temperatures

Designed for development testing of hydraulic valves, this stand will maintain constant temperatures from usual ambient values down to —100 F. Pull down time is a maximum of 1 hr. Temperature control is within ±2 deg of set point. An integral pump supplies 2 gpm at 3000 psi. Oil reservoir holds 10 gal.—*Hicks Corp., Boston, Mass.*

CIRCLE 511 ON READER SERVICE CARD

Shutoff Valve
. . . for high pressures

Model 949T valve is for use in high pressure gas or hydraulic systems in missiles and rockets. Positive, leakproof shutoff is provided by an O-ring which is automatically



withdrawn from the fluid stream as soon as the valve starts to open. A conical metal plug varies the orifice area to give throttling. Stem threads are sealed from the fluid stream. Operating torque is low and handle design gives a good grip. Body is type 303 stainless bar stock. Maximum pressure rating is 5000 psi.—*Circle Seal Products Co., Pasadena, Calif.*

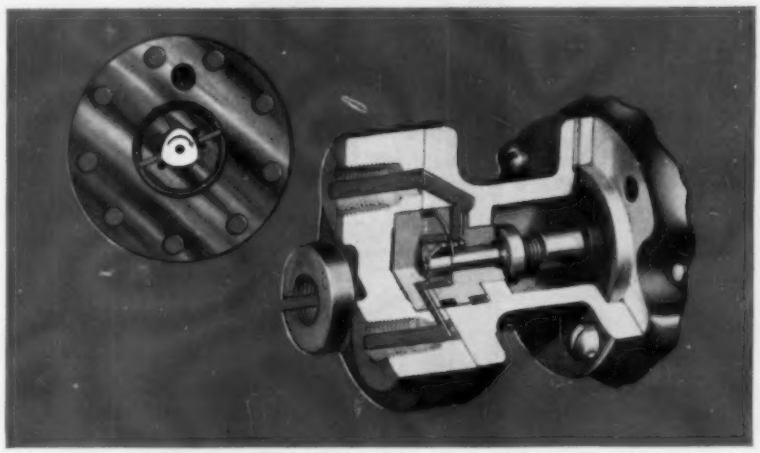
CIRCLE 512 ON READER SERVICE CARD

Continued on next page

YESTERDAY'S PIONEER . . . TODAY'S LEADER

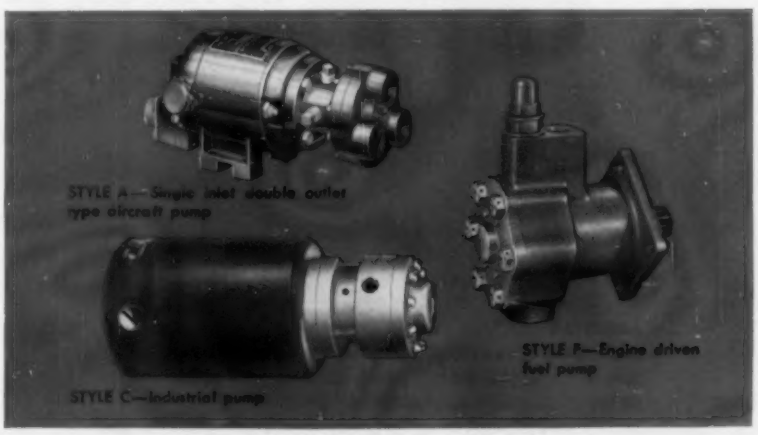
WELDON / FLUID METERING PUMPS

Positive Displacement Rotor Type. For Industrial Applications, Aircraft Anti-Icing and Aircraft Fuel.



IT'S SO SIMPLE!

The rotation of the rotor draws the fluid in through two passages, filling the cavities formed by the three lobes of the rotor. This fluid is sealed within these small cavities until it is forced through the two outlet holes by the floating blades. The flow may be kept uniformly divided through two outlet ports, or may be combined internally for passage through a single port.



COMPACT • LIGHT WEIGHT

Send for Weldon Manual and Catalog with detailed specifications and installation drawings, covering the full range of Weldon pumps in various capacities. Specify your requirements.

40 YEARS OF LEADERSHIP 1918—1958

THE WELDON TOOL COMPANY

3000 WOODHILL ROAD . . . CLEVELAND 4, OHIO

CIRCLE 140 ON READER SERVICE CARD

NEW

MINIATURE AGASTAT®

time delay relay

for . . . missile, aircraft and electronic applications

INSTANTANEOUS RECYCLING . . . reset time—less than .020 seconds

UNAFFECTED BY VOLTAGE VARIATIONS . . . time delay remains constant from 18 to 30 volts DC

ADJUSTABLE . . . time delays from .030 to 120 seconds

CHOICE OF OPERATION . . . for either energizing or de-energizing

SMALL . . . height—4⅝" . . . width—1-13/16" . . . depth—1½"

LIGHT . . . maximum weight—15 ounces

MEETS ENVIRONMENTAL REQUIREMENTS OF MIL-E-5272A

This new AGASTAT time delay relay is an externally adjustable, double-pole, double-throw unit. It incorporates the basic AGASTAT timing principle, proved by a half-century of reliable operation on automatic aids to navigation, in a space-saving miniature unit, built to withstand the rugged environmental conditions of missile and aircraft applications.

For specific information on the new AGASTAT relay for your application, write to Dept. A29-530.

AGA DIVISION — **ELASTIC STOP NUT CORPORATION OF AMERICA**

1027 Newark Avenue, Elizabeth, New Jersey

Pioneers in pneumatic timing

AVIATION COMPONENT DATA

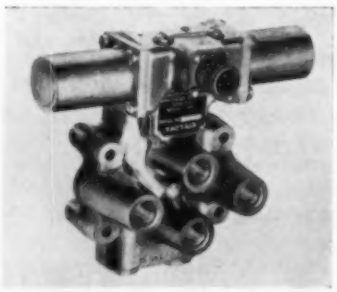
Quick-Disconnect Couplings

. . . for missile and aircraft use are described in a 26 page catalog. Photographs and complete specifications are included. Couplings are for a wide temperature range and a variety of fluids.—*Snap-Tite Inc., Union City, Pa.*

CIRCLE 513 ON READER SERVICE CARD

Four-Way Valve . . . works fast

Developed for use in a rocket release system, Model 9801 valve has a maximum energizing time of 0.05 sec. For pneumatic system



use, the solenoid-operated, spring-centered valve has a pressure range of 500 to 3000 psi. Weight is less than 1.9 lb. Dimensions are 5⅜ x 4¾ x 2 57/64 in. Solenoid current drain is ½ amp. Maximum external leakage is 3 cc per hr.—*Tactair Valve Div., Aircraft Products Co., Bridgeport, Pa.*

CIRCLE 514 ON READER SERVICE CARD

Time Delay Relay . . . is very reliable

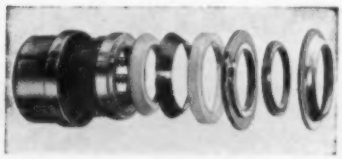
Repeatability of this timing relay is within 10% despite temperature variations of —65 to 260 F, voltage variation, vibration from 5 to 2000 cps, and maximum acceleration of 10 g. Repeatability is within 2% under most normal operating conditions. Timing begins when a 28-v, dc solenoid is energized. At the end of the time interval, a single-pole, double-throw switch rated at 4 amp is operated. Reset time is 0.05 sec. Timing range is from 1 sec to 15 sec. Unit is 2-½ in. long and 1-¾ in. diam. —*Eagle Signal Corp., Moline, Ill.*

CIRCLE 515 ON READER SERVICE CARD

CIRCLE 145 ON READER SERVICE CARD

Reciprocating Shaft Seal . . . for high temperature

Designated to withstand temperatures of 575 degrees F. at 4000 psi, this seal uses Teflon for sealing. Teflon, machined to a wedge shape



is compressed against the shaft by springs pushing against the inner wedge. The inner wedge slides against the face of the outer wedge. The outer wedge is also expanded outward to seal at this point. Brass spacers separate inner and outer wedges.—*Skinner Seal Co., Santa Ana, Calif.*

CIRCLE 516 ON READER SERVICE CARD

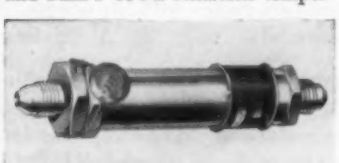
Portable Test Stand . . . for Skydrol

Type 20BNS, Model PHC test cart for use with Skydrol 500 fluid provides 20 gpm at 3000 psi. Stainless steel piping and explosion proof components are used. Pressure of 5000 psi at a reduced flow rate is also possible. The supercharged main pump is a variable-displacement, pressure-compensated type. The 60-gal tank is located above the pump inlet for gravity feed in case of supercharge pump failure. The air-oil heat exchanger will dissipate 40 hp at 20 gpm and temperature differential of 100 F. —*United Mfg. Co., Div. W. L. Maxson Corp., Hamden, Conn.*

CIRCLE 517 ON READER SERVICE CARD

Relief Valve . . . for air or nitrogen

MC 1625 relief valve meets applicable paragraphs of MIL-P-5518 and MIL-P-8564. Ambient temper-



ature range is —65 to 250 F. Outlet port is threaded for connection to an overboard drain line. Port connections are for ¼-in OD tubing. Weight is 0.16 lb.—*M. C. Mfg. Co., Lake Orion, Mich.*

CIRCLE 518 ON READER SERVICE CARD

WHICH SEAL WILL SOLVE YOUR PROBLEM?

Seals drawn to same scale.				
Type of Seal	**Standard**	**Modified**	**Bellows**	**Shaft Surface**
Pressure (PSI)	1000	500	250	75
Speed (FPM)	15,000	15,000	15,000	15,000
Temperature (°F)	350° to 450°	—360° to 350°	—360° to 700°	500° to 700°
Uses	Fluids including aviation fuel, synthetic lubricants, etc.	Rocket motors, HNO_3, H_2O_2, NPN, LOX, Ethylene Oxide	Applications calling for all-metal, high temperature sealing	Sealing gaseous mediums in a minimum amount of axial space
Send for	Bull. #7	Specially enginered	Bull. #18	Bull. #19

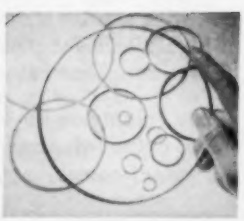
CAUTION: Maximum conditions indicated for each type do not necessarily imply that all are available in a single seal. Sealol engineers will gladly recommend the seal best suited to the operating conditions of your particular application. Write today . . . no obligation, of course!

SEALOL CORP
155 Post Rd., Providence 5, R. I.

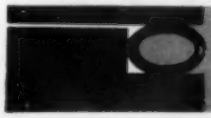
SEALOL

This trio's discordant tunes will likely land them in jail, ending their problem. If you prefer close-harmony in tight seals, United's Metallic O-Rings are the answer to problems involving metal-to-metal applications.

They fit any application calling for a positive, permanent seal against internal or vacuum pressures up to 10,000 p.s.i., in a temperature range from -70 to 1800°F. They are especially adaptable for sealing cylinder heads, air and hydraulic pressures, high octane fuels, vapors, gases, oils, solvents, chemicals, acids, vacuum and steam connections. Available in various metals and plating finishes, from 3/16" dia. to any size or configuration.



• free 22 page booklet describing United Metallic O-Rings, write (on your letterhead please) to Department N-2



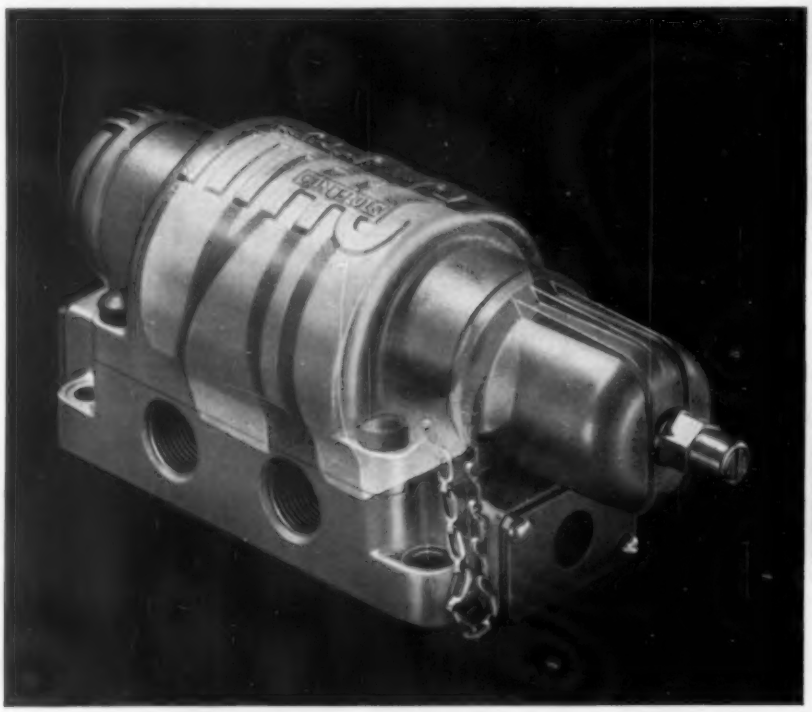
UNITED METALLIC "O" RING CORP.
Dayton, Ohio • Box 1035
Division of United Aircraft Products, Inc.

CIRCLE 126 ON READER SERVICE CARD

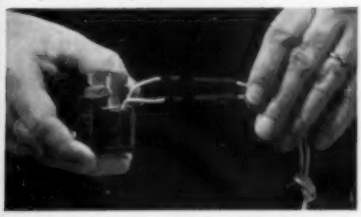
Introducing the revolutionary new MAC 4-way

DUAL-SPOOL

CIRCULAR-FLOW AIR VALVE



The MACsolenoid energizes the inner spool, releasing compressed air to activate the outer spool. There is no lag between spools. The shock load of the main spool is dissipated through rubber cushions.



The Dual-Spool's proved MACsolenoid has new instant plug-in wire lead connectors that are waterproof and vibration-proof. The solenoid and cover assembly detach in seconds without tools.

Features efficient spool-within-a-spool design...sells for about half the price of most other ½" to 1¼" valves... meets all J.I.C. specifications

MAC's new Dual-Spool air valves represent an entirely new principle in air valve design. They operate at speeds that meet any known requirement . . . with shorter stroke . . . direct operation . . . and a highly efficient *circular* air flow that provides full flow throughout rated capacities.

They operate on the *low current requirements of minimum amplified circuits* . . . needing just .8 amperes of inrush current and .125 amperes holding at 115 volts—60 cycles. The new Dual-Spool valves are compact, too . . . about one half the size of similar-use competitive valves (½" to 1¼") . . . and sell at about half the price in single- and double-solenoid models.

Fewer parts and simple design reduce maintenance. Integral conduit boxes connected by wiring channels permit optional wiring. Plug-in wire lead connectors speed up installation. The MACsolenoid—which operates up to 30 *million cycles* without appreciable wear—shaves replacement costs to a minimum.

4-way Dual-Spool air valves are now available in ½", ¾", 1" and 1¼" pipe sizes . . . are fully tested and guaranteed. Contact a MAC representative listed at the right or write direct for complete details.

Pat. applied for on all valve features ©MAC

MECHANICAL AIR CONTROLS, INC. MAC 10030 Capital, Oak Park, Detroit 37, Michigan

PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

ARKANSAS
Branch-Merwin Tool Specialists, 477 N. Bellevue, Memphis 5, Tenn., BRoadway 8-6102

CALIFORNIA
OAKLAND 8—The Rucker Co., 4700 San Pablo Ave., OLympic 3-5221
SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., LOrain 4-2521

FLORIDA
MIAMI SPRINGS—Aero Hardware & Supply Inc., 4301 Northwest 36th St., TUxedo 8-2414

ILLINOIS AND IOWA
CHICAGO 6—Walter Norris Engineering Co., Civic Opera Bldg., 20 N. Wacker Dr., STate 2-2804

INDIANA
EVANSVILLE 14—Neff Engineering Co., 2509 Washington Ave., GReenleaf 7-4141
FORT WAYNE 3—Neff Engineering Co., Station A, P.O. Box 2001, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS 2—Neff Engineering Co., 1955 Central Ave., WAlnut 5-5311
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MICHIGAN
BAY CITY—Fred Kober, 506 So. Chilson St., TWinbrook 2-2629
FLINT 2—Kober Sales Engineering Co., 1115 Root St., CEdar 2-7165
WESTERN MICHIGAN—Everett Adams, 17212 Sharon Road, Chesaning, Michigan, VIctor 5-3446

MINNESOTA
MINNEAPOLIS 9—Air & Hydraulic Equipment Co., 15 E. 38th St., TAylor 3-6118

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(**NORTHERN**) Machinery & Machine Supplies Co., Inc., 305 East 47th St., New York 17, New York, PLaza 8-0744
(**SOUTHERN**) Automation Aides, 1618 Willow Ave., Philadelphia 26, LaMott, Pennsylvania, MElrose 5-5555

NEW YORK
BUFFALO 26—C. H. Tepas Co., 137 Lamarck Drive, CIrcle 3210
NEW YORK 17—Machinery & Machine Supplies Co., Inc., 305 East 47th Street, PLaza 8-0744

OHIO
CINCINNATI 2—Fluid Power Engineering Co., 205 Keith Bldg., MAin 1-6640
CLEVELAND 9 (PARMA)—Fluid Power Engineering Co., 5451 Broadview Rd., FLorida 1-1199

OREGON
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PENNSYLVANIA
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TENNESSEE
MEMPHIS 5—Branch-Merwin Tool Specialists, 477 N. Bellevue, BRoadway 8-6102

TEXAS
DALLAS 35—Womack Machine Supply Co., 2010 Shea Road, FLeetwood 7-3871

WASHINGTON
SEATTLE—The Rucker Co., 1000 4th Ave., South, MAin 2783

WISCONSIN
MILWAUKEE 17—Neff Engineering Co., 5856 No. Pt. Washington Rd., EDgewood 2-1579

CANADA
MONTREAL—L. S. Tarshis & Sons, Ltd., 450 McGill St., Quebec, PLateau 2963
TORONTO—Trevor Babbs, National Time & Signal Co., 72 Shilton Rd., Agincourt, Ontario, OXford 1-4857

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN
MAC

NEW PRODUCTS

SOLENOID VALVES
. . . have no metal contact with fluid

Designation: Series SV-5100

Features: Designed to handle corrosive media, in some cases will

outlast stainless steel 100 to 1. It has a current drain of 10 watts maximum at 110 v ac. Valve is made of molded nylon with a plastic diaphragm seal that assures bubble tight sealing.

Valcor Engr. Corp.
Kenilworth, N. J.

CIRCLE 309 ON READER SERVICE CARD

TEST STAND
. . . tests hydraulic transmissions

Operation: Transmission to be tested is positioned in the stainless steel pan and connected to any of

the 12 gage outlets on the panel. A 30-gal. hydraulic power unit equipped with an 11-gpm pump, a 3-hp motor and a 40- micron filter provides full or partial pump capacity at pressures from 50 to 800 psi. A flow control valve and a relief valve control pressure and flow.

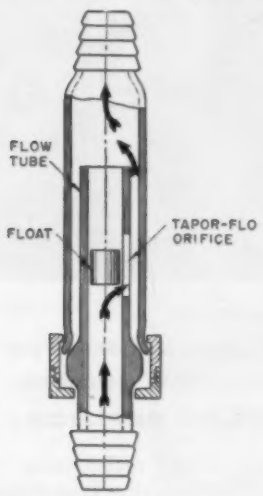
Temperature is maintained by a thermostat which controls the electric heater.

J. N. Fauver Co. Inc.
Detroit, Mich.

CIRCLE 310 ON READER SERVICE CARD

FLOW METER
. . . stabilized by "V" orifice

Designation: MB Series
Features: As flow rate increases or decreases, a float raises or falls in a precision-bored glass tube, proportionately exposing more or less of a V-shaped orifice. This makes float height directly proportional



to flow rate. The meter is available with serrated glass connections, ball joints, or glass flanges.
Specifications: Flow rates to 3.5 gpm and operating pressures to 80 psi.

C-Mar Corporation
Manasquan, N. J.

CIRCLE 311 ON READER SERVICE CARD

AIR HOSE COUPLER
. . is easy to assemble

Designation: H-52 Quik-Koupler

Features: Coupling was designed for use with type H-52 industrial vinyl hose, but can also be used with other air hoses. It is designed so that it can be assembled in the plant maintenance department.

Design: Couplings are made of brass with stainless steel springs and valves. The plugs are cadmium plated steel or brass. Working pressure is 125 psi.

Hoffman Engineering Co.
Chicago, Ill.

CIRCLE 312 ON READER SERVICE CARD

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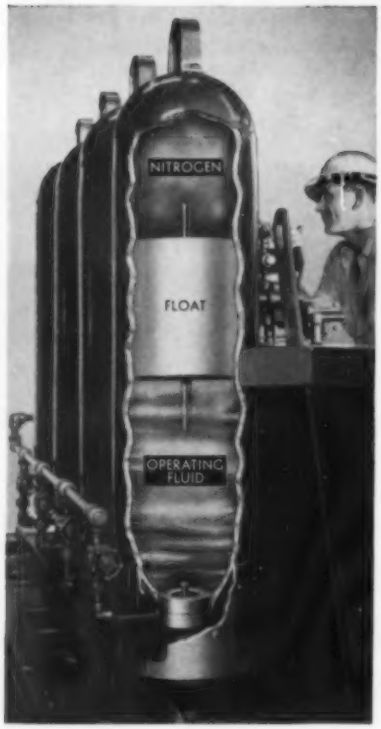


NEW TYPE ACCUMULATOR WITH NO COSTLY RUBBER PARTS TO REPLACE

You can forget maintenance with Payne Non-Separator Type Accumulators on the job. Notice above how the free-moving float* takes the place of unreliable rubber goods. Pre-charge pressure is securely retained when the float at its low position triggers a positive shutoff valve. In combination with Payne fast-acting pumps and automatic controls, these economical accumulators instantly produce the correct pressure for a wide range of hydraulic applications. They are built in sizes from one to twenty gallons with maximum working pressure to 3,000 psi. Any volume is available with multiple units. It's easy to understand why more and more cost-conscious companies are choosing the reliability and sound economy of Payne Non-Separator Type Accumulators.

*Patents Pending

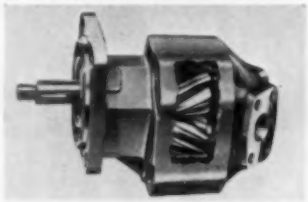
Payne MANUFACTURING COMPANY INC.
P. O. Box 9364 Houston 11, Texas

NEW PRODUCTS

HYDRAULIC GEAR PUMP
. . . operates at high speed

Designation: Hydroid Pump

Features: Pump gears are made with an elliptical profile that eliminates trapping of liquid between the teeth. It can be operated at speeds over 4000 rpm and pressures to 1500 psi. Ability to run at high speeds eliminates the need



for reduction gears. Designs will be tailored for materials handling, construction, and aircraft hydraulic systems.

Hupp Aviation Co.
Division of Hupp Corp.
Chicago, Ill.

CIRCLE 313 ON READER SERVICE CARD

LIMIT SWITCHES
. . . have low actuating force

Features: They require only 125 in-ounces to trip and with main-

tained contact arrangement the operating force required is only 40 in-ounces. The switches provide for two separate circuits by having a double break contact arrangement. They can be supplied in spring centered or snap action in either direction.

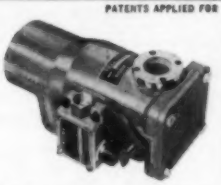
R. B. Denison Mfg. Co.
Cleveland, Ohio

CIRCLE 314 ON READER SERVICE CARD

Continued on page 126

PATENTS APPLIED FOR

Oil filters that tell when they're dirty... will never starve a pump... are easy to clean... are full flow



SEE condition of oil thru glass
FULL FLOW by-pass when filter is clogged
TELLS when to clean, by remote signal switch
EASY access to dirty cartridge

Above: 20-gpm Tell-Tale unit. Can be upped to 40 gpm with pleated filter cartridge. 50-gpm and 75-gpm Tell-Tale units (not shown) are also available.

Left: Removing the filter cartridge from a 5-gpm Tell-Tale unit. Pleated filter rating for this same unit is 10 gpm. While the optional electrical limit switch indicator is shown here, the visual indicator model is also available.

Below: 100-gpm Tell-Tale filter. Pleated filter rating is 200 gpm. All cartridges, plain or pleated, are available in five different degrees of filtration (from .0008 to .009" openings).

Rosaen Tell-Tale® units do more than filter. They indicate when the filter needs cleaning. And if ignored they by-pass oil to protect the pump (and they indicate this, too). Filters are necessary, but the high cost of filter inspection is not. Get the filter that tells when to clean, and never starves a pump. Write for more information.

The ROSAEN COMPANY
1776 EAST NINE MILE ROAD • HAZEL PARK, MICHIGAN

Dealers: Write for information

CIRCLE 143 ON READER SERVICE CARD
CIRCLE 104 ON READER SERVICE CARD
CIRCLE 13

BACKED BY A QUARTER OF A CENTURY OF
LOCKHEED HIGH-PRECISION HYDRAULICS

HYDRAULIC SLAVE CYLINDERS

Expressly made to give long service

Our first consideration in producing Lockheed hydraulic equipment is to ensure long life and reliability, with the minimum of maintenance under the arduous conditions imposed by industrial use, and we put these requirements before initial cost and other factors.

Lockheed slave cylinders are to be found in boiler houses and gas plants throughout Britain, working satisfactorily after ten years without attention. The conditions generally involve heat, cold, fumes and dust.

Among Lockheed features in quality design and manufacture which contribute to this result are

1 Hard-Chrome-Plated Bore
2 Hard-Chrome-Plated Ram
3 Ram Bearing and Piston of adequate length to prevent knuckling when extended
4 Mirror finish on rams and in bore
5 Long life seals of LOCKHEED design
6 Flexible protective boot on ram extension

In addition to the type of cylinder shown, we design many types of cylinder to the individual requirements of customers.

Further particulars of these units will be sent on request—kindly mention this journal.

Our engineers are always at your service to discuss industrial hydraulics.

AUTOMOTIVE PRODUCTS COMPANY LIMITED,

SHAW ROAD, SPEKE, LIVERPOOL, 19, ENGLAND, Telephone: Hunts Cross 2121.

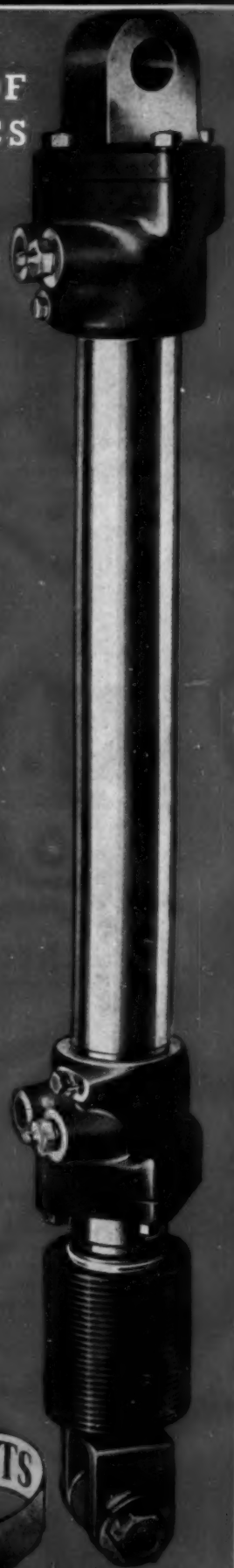
Lockheed

REGD TRADE MARK

INDUSTRIAL HYDRAULICS

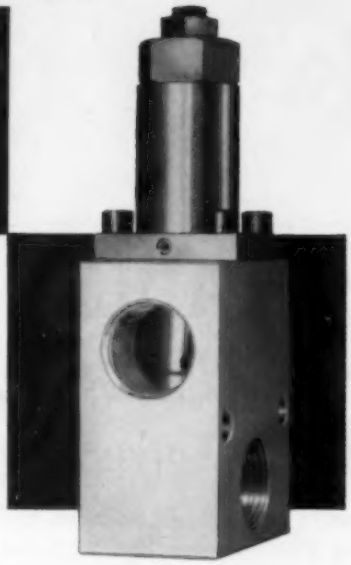
BRITISH MADE

COMPLETE INSTALLATIONS OR INDIVIDUAL UNITS



CIRCLE 41 ON READER SERVICE CARD

New Improved Differential Piston Type RELIEF VALVES



Now Available In Four Pressure Ranges

- Good Pressure Control . . . cracking pressure 90% or better of full open
- Safe — Dependable . . . will not stick open
- Permit designers to use the most economical and efficient valve to meet his requirements.
- Quiet
- Inexpensive

FOR OIL

PIPE SIZE
¼", ⅜", ½", ¾" & 1"

PRESSURE	
100 to 800 psi	1000 to 3000 psi
250 to 1500 psi	1500 to 5000 psi

Write for detailed literature

Fluid Controls, inc.

Member of Fluid Power Association

Manufacturers of Hydraulic Valves and Devices

Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

NEW PRODUCTS

SPECIAL TOOLS . . . speed make-up of hose assemblies

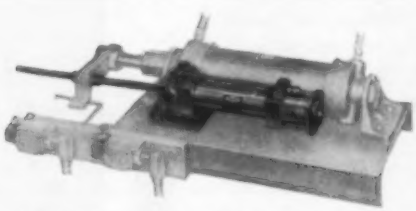
Features: Speed wrench sets and a handy strap-vise are now available for quicker and easier assembly of

re-useable fittings onto rubber covered no-skive hose. Each set includes speeder with revolving grip, sliding T-handle, adapters, and wrenches.

Parker Fittings & Hose Division,
Parker-Hannifin Corp.
Cleveland, Ohio

CIRCLE 315 ON READER SERVICE CARD

VERI-TROL HYDRAULIC CHECKING CYLINDERS



— designed for use with air cylinders to smooth out stroke variations due to compressibility of air under irregular load conditions.

- ACCURATE SPEED CONTROL is dial-set, load-compensated to assure uniform stroke speed even with irregular loads.
- VISIBLE OIL RESERVOIR, easy to refill.
- 2,000 LB. CHECKING CAPACITY on out stroke, free return.
- 2", 4", 6", 9", 12", 15" and 18" checking stroke lengths.
- IDEAL FOR LOW-COST TOOL OR WORK-PIECE FEEDS.

Take the bumps and jumps out of air cylinder operation — install VERI-TROL checking cylinders wherever you want smooth, accurately-controlled stroke speed. Write now for free data bulletin.

Modernair CORPORATION

Dept. B-5, 400 PREDA STREET, SAN LEANDRO, CALIF.

Member National Fluid Power Association 34

TRU-SEAL Saves hours in piping installations

PAT. PENDING

Eliminates leaks in oil, air, water, vacuum, chemical lines

Tru-Seal saves hours in assembling piping installations because it enables you to run your pipe lines in any direction you wish, quickly and easily—without having to recut and re-thread piping sections. Wherever used on air, oil, water, steam, vacuum or chemical lines, it seals perfectly at —100° F. to plus 500° F.—*without the use of pipe dope.* Its installation requires only light tightening torque, thus eliminating over-tightening damage to valves, pumps, compressors, and other fittings.

For further information write

TRU-SEAL DIVISION
FLICK-REEDY CORPORATION

2008 N. Hawthorne, Melrose Park, Ill.

"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

1
Thread Tru-Seal on pipe or fitting as far as it will go hand tight.
SEAL SIDE
2
Thread pipe or fitting 3 threads into port. Point in desired direction.
3
Tighten Tru-Seal to complete leakproof assembly (only light torque required).

CIRCLE 89 ON READER SERVICE CARD

CIRCLE 123 ON READER SERVICE CARD

CYLINDERS
. . . for mobile and farm use

Specifications: Available in 8 bore sizes from 1½ to 6 in with 10

standard mounts. Furnished with O-ring seals for pressures to 2000 psi and cup-type packings for 3000 psi. Stroke length to 10 ft is standard.

Hemco Mfg. Co. Inc.
Argonia, Kansas

CIRCLE 316 ON READER SERVICE CARD

SOLENOID VALVES
. . . with large orifice capacity

Designation: R Series

Design: Valves are pilot operated piston type and have ¼ in orifice and ¼ in NPT ports. They are

available normally open or normally closed, and have brass bodies and stainless steel internal trim.

Features: Valves are designed for use with air, water and oil at pressures to 200 psi.

Skinner Electric Valve Div.
New Britain, Conn.

CIRCLE 317 ON READER SERVICE CARD

THREAD PROTECTORS
. . . snap on and stay on

Features: They are made from plastic coated kraft paper and have a metal staple that fits into the threads. Protector can not be re-

Continued on next page

UCON
BRAND
HYDROLUBES

HELP

PROTECTION The fire-resistance of CARBIDE's fire-resistant hydraulic fluids has been proved by severe, exhaustive laboratory tests. And, in actual service, water-base UCON hydrolubes have prevented serious fires and injuries during more than 10 years of routine use in all types of industrial hydraulic equipment. The common fire hazards connected with hydraulic operations are eliminated when UCON hydrolubes are used. UCON hydrolubes are classified as acceptable, less hazardous fluids by Factory Mutual Laboratories.

ECONOMY UCON hydrolubes 150-CP and 275-CP are the economical answer to fire-resistance in hydraulic fluids. Most commercial hydraulic equipment can be easily converted to UCON hydrolubes with a minimum of time and expense. UCON hydrolubes have no harmful effects on most packings or seals. In fact, in many instances, reduced leakage losses have been reported. UCON hydrolubes also provide maximum protection against liquid and vapor phase corrosion and have outstanding anti-wear characteristics—thus, pump replacement costs are also held to a minimum.

Why not get all the facts on how UCON hydrolubes can mean protection plus economy for you. Write today for the booklet, "UCON Hydrolubes Spell Safety," F-40134.

UNION CARBIDE CHEMICALS COMPANY

Division of UNION CARBIDE Corporation

30 East 42nd Street, New York 17, N. Y.

"Ucon" is a registered trade-mark of UCC.

CIRCLE 125 ON READER SERVICE CARD

NEW PRODUCTS

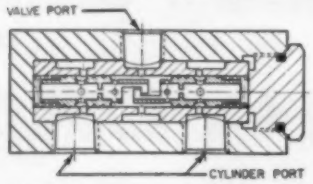
moved without unthreading it. They are available for pipe and rod sizes to 1 in. The plastic coating protects against moisture, grease and chemicals.

Precision Paper Tube Co.
Chicago, Ill.

CIRCLE 318 ON READER SERVICE CARD

FLOW DIVIDER
. . . is pressure compensated

Operation: Flow divider receives the flow from one pump and divides it into two equal flows with an accuracy of 10%. The device



operates as a pair of pressure compensated flow regulators to keep the pressure drop equal across two orifices. As the flow increases through one orifice, the pressure difference between the two causes a sliding spool to shift over the orifice and equalize the flow.

Specifications: Made in two sizes, 1 to 4 gpm and 3 to 10 gpm and in ⅜-in. pipe ports.

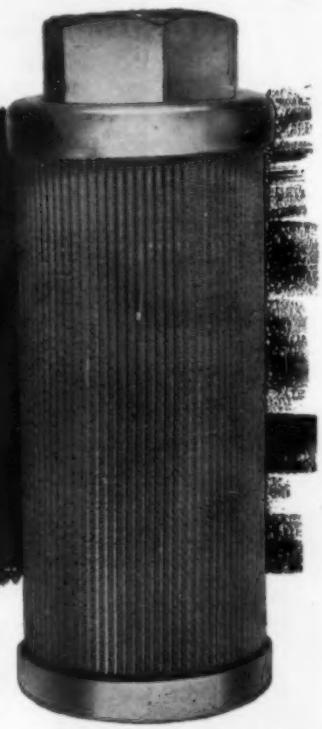
Fluid Controls Inc.
Mentor, Ohio

CIRCLE 319 ON READER SERVICE CARD

Capital

HYDRAULIC OIL FILTER with Monel Metal Insert

Reservoir Type for Hydraulic and Oil Re-circulating Machinery



EASY TO INSTALL—EASY TO CLEAN
LONG LIFE—LOW COST—SIZES AND SCREENS TO FIT YOUR NEEDS

★ ONLY THREE PARTS
★ MEETS J.I.C. STANDARDS
★ GREATER FILTERING AREA
★ SPECIAL TRAP-WEAVE MESH

Specially woven MONEL wire cloth and a new method of compact corrugation, gives triple protection with less space than other filters of like capacity. Trap-weave mesh stops thin, elongated particles with NO loss of efficiency.

Non-corrosive, non-toxic materials throughout. Easily cleaned with an ordinary brush.

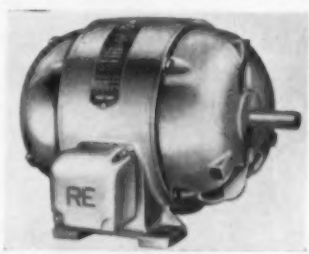
Write for descriptive circular.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

ELECTRIC MOTORS
. . . to new NEMA dimensions

Features: Motor frames are all aluminum which gives 25% less weight than cast iron, and are available in frame sizes from 182 to



326U. Horsepower range is ½ to 40. Special modifications such as face and flange endbells and modifications for fluid couplings and gear reducers can be made.

Reuland Electric Co.
Alhambra, Calif.

CIRCLE 320 ON READER SERVICE CARD

DE-ACCELERATION MANIFOLD
. . . controls air cylinder speed

Features: Manifold provides rapid movement plus controlled cushioning at any point in the cylinder stroke.

Design: It consists of two 3-way normally open pilot control valves and one 3-way directional flow, pilot operated control valve. All

Continued on page 130

New Parker No-Skive Hoze-lok

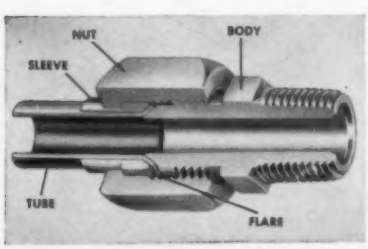
FASTER . . . EASIER . . . RE-USABLE

No more frustrating jobs of stripping off the covers of hydraulic wire-braid, rubber-covered hose! No more ragged hose ends that refuse to enter fitting sockets!

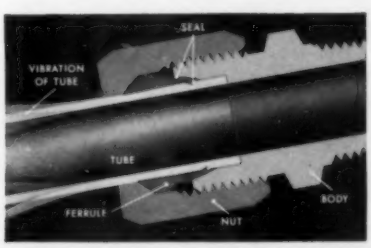
New Parker Hoze-lok Fittings save you all this time and trouble. Skiving of hose covers is *not* necessary. Simply screw the hose (with cover intact) into the socket and then screw the nipple in to complete the make-up. What could be easier . . . or more effective?

Versatile Hoze-lok Fittings are re-usable . . . an important benefit to users of your equipment. Select your fittings from the new series of Hoze-lok styles and sizes, with four different connecting ends and full range of adapters.

Ask your Parker Distributor or mail this coupon today for catalog about Parker Hoze-lok Fittings and for details about Parker Triple-lok and Ferulok.



Triple-lok Flare Fittings . . . the easiest, fastest, safest way to tube up even in close quarters. Leakproof even under severe vibration, high pressures. Meet S.A.E. Hydraulic Tube Fittings Standard.



Ferulok Flareless Fittings for high-pressure, heavy-wall tubing. Double seal makes Ferulok leakproof, vibration-proof. You can see the "bite." Meet S.A.E. Hydraulic Flareless Tube Fittings Standard.

PARKER FITTINGS AND HOSE DIVISION

Parker Hannifin
creative leader in fluid systems

PARKER FITTINGS AND HOSE DIVISION
Section 429-B
Parker-Hannifin Corporation,
17325 Euclid Avenue
Cleveland 12, Ohio

Please send:

- ☐ *Hoze-lok* Catalogs 4433, 4434
- ☐ *Triple-lok* Catalog 4310
- ☐ *Ferulok* Catalog 4320

Name_____

Title_____

Company_____

Address_____

City_____ State_____

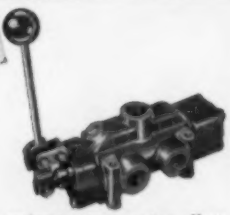
ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

GEAR-TYPE HYDRAULIC PUMPS

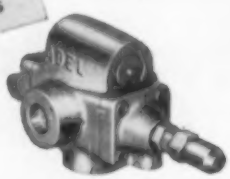
For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES



4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

VOLUME (FLOW) CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES

Valves allow free flow in one direction only. Many variations available. 3000 psi.

Reliability

ADEL PRECISION PRODUCTS

A DIVISION OF GENERAL METALS CORPORATION

HUNTINGTON 4, WEST VIRGINIA

Manufacturers of MARINE & INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT

DISTRIBUTORS:

ARIZONA
Air-Draulics Company
Phoenix, Arizona

CALIFORNIA
Haskel Engineering & Supply Co.
Glendale 4, California
Haskel Engineering & Supply Co.
San Francisco 3, California

CONNECTICUT
Air & Hydraulic Engineering Co.
New Haven, Connecticut

INDIANA
The Neff Engineering Co.
Fort Wayne 3, Indiana

MICHIGAN
Industrial Air & Hydraulic Equipment Company
Detroit 15, Michigan
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MINNESOTA
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Edina Branch
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Corby Supply Company
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L. H. Monsees,
Independence, Missouri

NEW YORK
Power Drives, Inc.
Buffalo, New York
Tri-State Supply Company
Brooklyn 33, New York

OHIO
Scott Equipment & Engineering Company
Dayton 10, Ohio
Wyatt Sales Company
Cleveland 15, Ohio

OREGON
Russ Chamberlin Company
Portland 14, Oregon

PENNSYLVANIA
Frank T. Donnelly Company
Pittsburgh 38, Pennsylvania

RHODE ISLAND
Lincoln Supply Company
Pawtucket, Rhode Island

TEXAS
Air-Draulic Equipment Company
Houston, Texas

UTAH
Robert Taylor & Sons
Salt Lake City 10, Utah

WASHINGTON
Russ Chamberlin Company
Seattle, Washington

NEW PRODUCTS

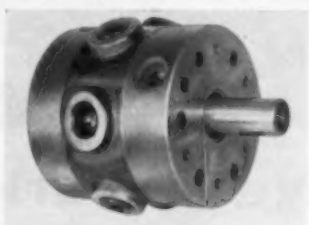
valves are mounted and wired on a cast aluminum manifold. The directional flow valve is actuated by limit switches and cams located at the required cushioning point in the cylinder travel.

Valvair Corp.
Akron, Ohio

CIRCLE 321 ON READER SERVICE CARD

RADIAL PISTON PUMP . . . has multiple outlets

Features: Housing is made of semi-steel and the shaft, rotor and pistons are hardened and ground steel. The pistons are individually



fitted by selective fine honing and the bearings operate flooded with oil. Pump will deliver 8 gpm at 1200 rpm and has a pressure rating of 3000 psi. It has 6 pistons and can have up to 6 separate discharge ports.

Brand Hydraulics
Omaha, Nebr.

CIRCLE 322 ON READER SERVICE CARD

2000 PSI CYLINDERS . . . with interchangeable mountings

Features: Five different mountings are available, foot lug, center lug,

front flange, rear flange, and clevis. All mountings are interchangeable. Cylinders are made in sizes 2 to 8 in. bores and strokes to 160 in. Other features are: short alloy steel tie bolts, automotive type piston rings, bar steel end heads, and bronze ram guide.

The Oilgear Co.
Milwaukee, Wis.

CIRCLE 323 ON READER SERVICE CARD

Continued on page 132

ACCO
Helicoid Gage
U.S.A.

NOTHING BUT THE BEST IN GAGES FOR WORKING PRESSURES FROM 30" VACUUM TO 10,000 p. s. i.

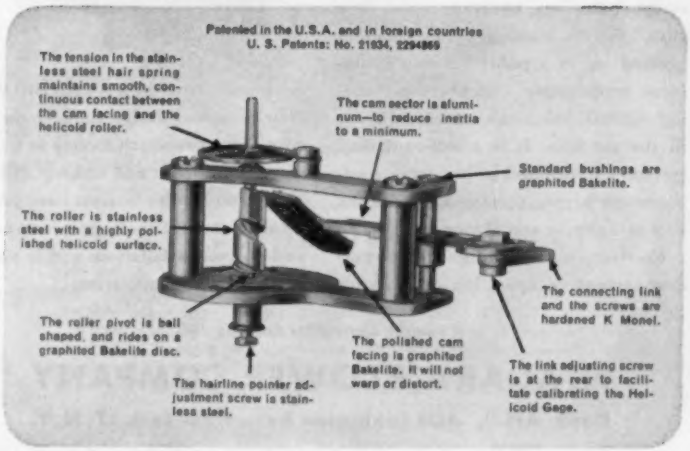
Shock-Proof Cam Actuation (no gears—no teeth) Makes Helicoid Gages Ideal for Hydraulic Services

Designed for pulsating and impact hydraulic service, the Helicoid movement releases at zero in the event of sudden pressure reduction. This eliminates shock on pointer and movement by reducing impact of pointer against pointer stop pin. This protects the gage mechanism where gages may be subject to occasional vacuum.

The superiority of Helicoid Gages is most evident in severe service—wherever a gage is subjected to violent pressure pulsations or certain severe mechanical vibrations.

The *sustained accuracy* of Helicoid Gages over *millions of cycles* is explained by the details of design and construction of the Helicoid movement shown at the right.

Rolling action of the cam facing against the roller surface . . . graphited Bakelite bushings, roller pivot base and cam facing . . . K Monel connecting links and screws . . . all such Helicoid features protect against wear and corrosion and assure sensitivity, sustained accuracy and trouble-free operation through millions of cycles.


Patented in the U.S.A. and in foreign countries
U. S. Patents: No. 21934, 2294869
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is aluminum—to reduce inertia to a minimum.
Standard bushings are graphited Bakelite.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphited Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

HELICOID GAGE CARTRIDGE SNUBBER

(Patent pending)

This is a simple, effective throttling device to reduce or eliminate pulsations of the gage pointer. There are no moving parts, no adjustments needed. Available in three types in powdered bronze or stainless steel for air, gas, water, steam, medium or heavy liquids.

Enlarged cutaway view

Threaded cartridge body for assembly in any Helicoid Gage tapped socket shank

EASIEST ADJUSTMENT AND CALIBRATION

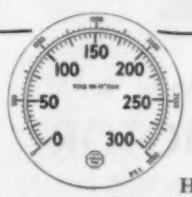
Only Helicoid Gages have the external pointer adjustment pictured here. The Helicoid type adjustment cannot be jarred out of position.

Calibration of Helicoid Gages is accomplished easily, without removing dial or pointer, because the link adjusting screw is at the rear of the system.

TUBES BUILT FOR MILLIONS OF PRESSURE PULSATIONS

To fit the wide range of applications, Helicoid Bourdon tubes are available in four materials—alloy steel, K Monel, stainless steel and phosphor bronze.

All Helicoid tubes are made from seamless tubing and are carefully designed to give maximum torque and minimum stress. When used within the dial range, they will withstand many millions of pressure pulsations and will not stretch, leak nor crack.



DOUBLE SCALE DIAL SHOWS TONS ON RAM AND PSI

Helicoid Gage dials are supplied in jet black with white figure markings or in dull white with black figure markings. They are constructed of laminated phenol with a transparent plastic surface and the longest possible scale length for more accurate readings. They are non-corroding, will not discolor nor fade and will not crack, chip nor peel.

Helicoid Gage Division
AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

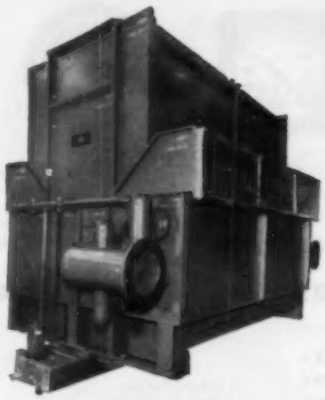
ACCO
A C G
TRADE MARK

Helicoid gives you all these features at prices that are competitive in the quality gage field

CIRCLE 56 ON READER SERVICE CARD

CIRCLE 83 ON READER SERVICE CARD

ECONOMICAL COOLING OF GASES AND COMPRESSED AIR



Cooling gases or cooling and removing moisture from compressed air, the Niagara *Aero* After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point below the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling water supply, solving the problems of water supply and disposal.

Cooling-water savings and power-cost savings in operation return your equipment costs in less than two years. New sectional design reduces the first cost, saves you much money in freight, installation labor and upkeep. Niagara *Aero* After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

Write for Descriptive Bulletin 130.

NIAGARA BLOWER COMPANY

Dept. AH-5, 405 Lexington Ave., New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada

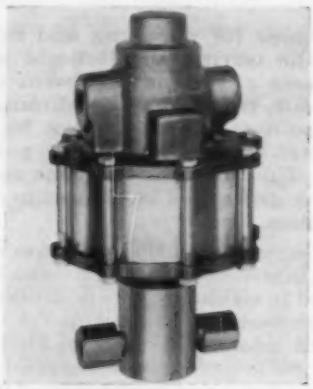
NEW PRODUCTS

AIR-OPERATED HYDRAULIC PUMPS

. . . produce 25,000 psi

Designation: SC 10-500 Series

Application: Designed for static and burst pressure testing, flow



tests which require low flows, and operating hydraulic equipment.

Features: Units can be used with

7 Horsepower . . . only 7⅝" high!

It's NEW! Variable-speed Model 16AM

GAST AIR MOTOR

Here's compact, explosion-proof power! Only 14⅜" x 8" x 7⅜" — wt. 65 lbs. — yet up to 7 h.p. on 90 lbs. air pressure. Speed variable from 300 to 2,000 r.p.m. with simple valve control. Overloads can't burn it out — stalling does no harm.

Has foot, also tapped holes for flange mounting to your machine. Use as original equipment or in plant to drive hoists, mixers, pumps, fans, etc. Priced at $200.

Write for your copy of Bulletin 16AM.

GAST MANUFACTURING CORP., P.O. Box 117-D
Benton Harbor, Michigan

See Catalog in Sweet's Design File

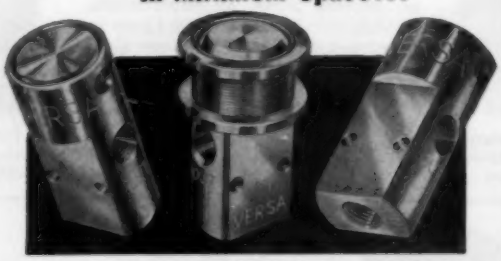
GAST ROTARY

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 29 IN.

"Air may be your answer!"

Versa "A" Valves

Give MAXIMUM Capacity In MINIMUM Space...



- Versa solves the space problem with a truly economic valve.
- The overall size of the Versa "A" valve is only 2" high by 1" in diameter, yet it has the capacity of much larger valves.
- Ideal for controlling cylinders, instruments and larger pilot valves.
- Available in ⅛" NPT in 2-way & 3-way types with or without button guard, in either normally open or closed models.
- Simple to mount on equipment or can be furnished for panel mounting.
- Prices range from $4.00 to $6.50 each.
  For complete information write today for Folder #143.

VERSA

VERSA PRODUCTS COMPANY INC.
248A SCHOLES STREET, BROOKLYN 6, N.Y.

FREE CATALOG! Write today for your free copy of Versa's Catalog #14.

CIRCLE 46 ON READER SERVICE CARD

CIRCLE 147 ON READER SERVICE CARD

water or oil and will develop 25,000 psi hydraulic pressure from 100 psi air pressure. Pumps are fully automatic and will operate only long enough to replace the fluid used by the system.

SC Hydraulic Engr. Co.
Los Angeles, Calif.
CIRCLE 324 ON READER SERVICE CARD

LIMIT SWITCH
. . . controls 4 circuits

Features: Actuation lever is adjustable in a full 360 deg sweep in two planes, and spring switch is easily replaceable. Switch can

control four circuits for pilot or line duty.

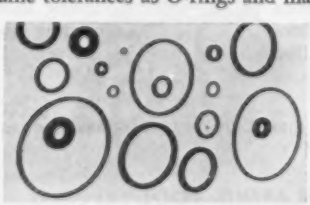
Specifications: Electrical rating is 2 hp at 230 v ac, 1 hp at 115 v ac, and pilot duty at 250 v dc.

Robertshaw-Fulton Controls Co.
Columbus, Ohio
CIRCLE 325 ON READER SERVICE CARD

RECTANGULAR SEAL RINGS
. . . interchangeable with O-rings

Designation: Tetraseals

Features: Seal rings maintain the same tolerances as O-rings and may



be used in any standard O-ring groove. The seals can be made from any standard or specially developed compounds of natural, synthetic, or silicone rubber.

Goshen Rubber Co. Inc.
Goshen, Indiana
CIRCLE 326 ON READER SERVICE CARD

Continued on next page

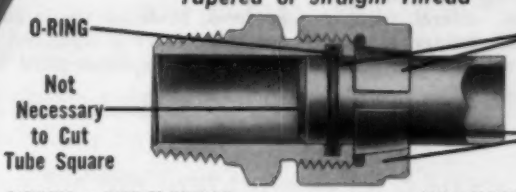
A TOP NAME IN THE INDUSTRY

LENZ COMPANY

A Complete Line of Fittings and Connections for any Type of Piping Application . . .

Featuring LENZ O-RING TUBE FITTINGS

Tapered or Straight Thread



PATENTED • PATENTS PENDING J.I.C. APPROVED

NO METAL TO METAL SEAL!
NO EXACT TUBE LENGTH NECESSARY!

Lenz fittings seal with standard, stock O-Rings. At zero pressure the initial compression furnishes necessary sealing force . . . the higher the pressure the tighter the seal. Every joint becomes a union!

LENZ FITTINGS pay for themselves over and over again by reducing installation and maintenance costs. . . only a hacksaw and a file needed . . . no periodic tightening . . . remain leakproof and reusable no matter how often reassembled . . . Ideal for all tubing on hydraulic, air or vacuum systems.

New LENZ PRODUCTS

PIPE FITTINGS

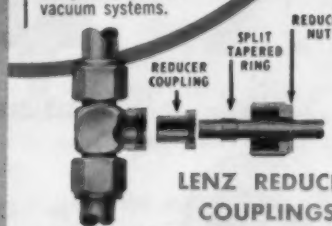
A complete line of connectors, elbows, crosses, tees, bushings, couplings, nipples and plugs . . . for every pipe need.

HOSE FITTINGS

Perfectly matched hose assemblies . . . a full line of re-usable fittings and hose lengths in low, medium and high pressure ranges.

AIR BLEEDER VALVES

Compact, functional . . . only two metal parts . . . no packings. Maintain maximum operating efficiency by eliminating air from lines.



LENZ REDUCER COUPLINGS

Makes possible line reductions on any leg by use of standard adapters and adapter nuts. Eliminates large inventory of special fittings and possibility of obsolesence from engineering changes. Full range of sizes.

OTHER LENZ PRODUCTS

In addition Lenz manufactures and supplies a full range of sizes in HYDRAULIC TUBING . . . INDUSTRIAL HOSE . . . STEMS and JOINERS . . . DEBURRING CUTTERS . . . TUBE CUTTERS . . . and TUBE BENDERS. See our ad in Thomas Register, under Fittings: Hydraulic, for complete listing.

Free! Write For newly released LENZ catalogs for complete product line and sizes on above products . . . Ask to be put on our mailing list.

Representatives in Principal Cities

LENZ COMPANY

3303 Klepinger Road
DAYTON 1 • OHIO
Phone: CRestview 7-9364

CIRCLE 69 ON READER SERVICE CARD

NEW PRODUCTS

SERVO VALVE
. . . has accuracy and flexibility

Designation: Model E-11089-4

Features: This electro-hydraulic servo valve has only four moving parts, main spool, control spool, sleeve, and feedback linkage. It has speed regulation to 1/10 of 1 percent and positional accuracy to .001 in. Valve can be sub-plate mounted or manifolded to a hydraulic motor. It is rated at 10 gpm flow on pressures to 3000 psi.

Vickers Inc.
Detroit, Mich.

CIRCLE 327 ON READER SERVICE CARD

RESET TIMER
. . . for hazardous locations

Features: Made for use in hazardous areas, timer is contained in a NEMA VII explosion-proof housing, designed for flush mounting. It features a cycle progress pointer and is available in time ranges from 10 sec to 10 hrs. Contacts are

rated at 10 amp, 110 or 230 v. Units have a maximum of 4 load circuits.

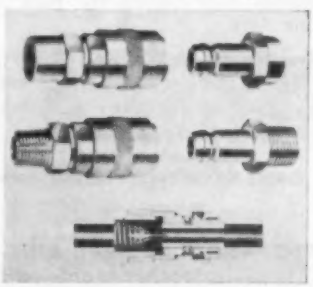
Eagle Signal Corp.
Moline, Ill.

CIRCLE 328 ON READER SERVICE CARD

QUICK DISCONNECT COUPLINGS
. . . permit large flows

Designation: D Series

Features: Couplings are designed to be interchangeable with other couplings on the market. They offer high flows with low pressure



drop and are available for pressures to 10,000 psi. End connections include male and female pipe threads, and hose stems in sizes from ¼ to ¾ in. Coupling locks automatically without turning and allows a full 360 deg swivel.

Perfecting Service Co.
Charlotte, N. C.

CIRCLE 329 ON READER SERVICE CARD

FLARING TOOL
. . . speeds tube flaring

Designation: Kwik-Flare

Features: This fast, precision flaring tool provides flexibility for a wide range of flaring work. It has a self-centering flaring cone which gives uniform flares. Detents

Continued on page 136

The ARROW AUTOPNEUMATIC CONTROL is the answer to your compressed air problems

Write for Free Catalog

ARROW TOOLS, INC.
1934 S. Kostner Ave.
Chicago 23, Illinois

NEW precision FLOW CONTROL at production prices

MULTI-RANGE FLOW CONTROL

- extra-sensitive flow control adjustment...for precise flow settings
- temperature-viscosity compensated...no change in selected flow rate
- available for the first time in all 3 sizes...¼"—⅜"—¾"

EXCLUSIVE WITH DENISON

Here's how to solve the problems of uniform feed rate . . . optimum precision work finish and cutter life so vital in modern machine tool equipment.

With the new Denison Multi-Range Flow Control in your design system, you can count on these important advantages and features . . . all pioneered through Denison advanced engineering:

- **PRECISE FLOW SELECTION** . . . is made possible through a new extra-sensitive control with an exceptionally wide span of adjustment in any given range.
- **MULTI-RANGE CONTROL** . . . allows one model to do the work of many—also simplifies your inventory. Adjustment from one range to another is guarded by stops to afford safe, simple, foolproof operation.
- **UNIFORM RATE OF FLOW** is assured because Multi-Range Flow Control is virtually free from flow change due to temperature-viscosity changes.
- **SURGE OVERTRAVEL VIRTUALLY ELIMINATED** —by simple adjustment—to avoid erratic feed of slides as the valve finds its setting.
- **BUILT-IN RELIEF VALVE** saves space and cost of additional piping.
- **BUILT-IN CHECK VALVE** permits reverse free flow.
- **REQUIRES NO EXTERNAL DRAIN.**
- **PRODUCTION PRICED** . . . and built to JIC Standards for operating pressures to 2000 psi.

MACHINERY DESIGNERS—ENGINEERS!
Write for Bulletin VFC-3.

INFINITELY VARIABLE CONTROL—The maximum capacity in a given range can be *varied infinitely* to permit setting the full scale of the valve itself to the exact maximum that the system requires.

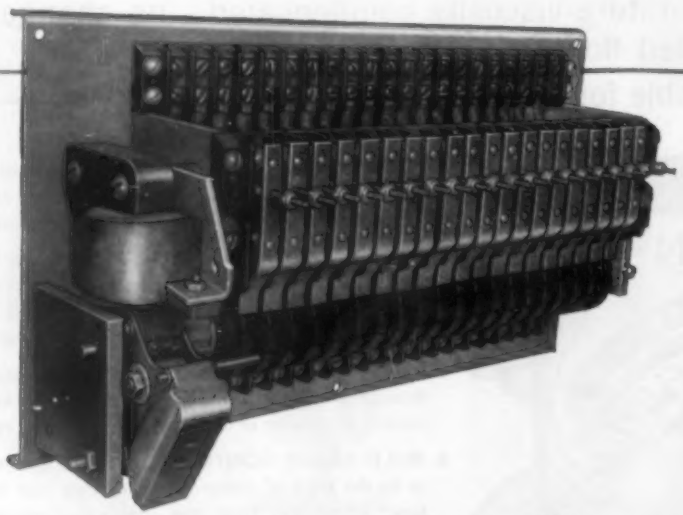
Denison, Denison HydrOILics and Multi-Range are registered trademarks of Denison Eng. Div., ABSCO

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1166 Dublin Road • Columbus 16, Ohio

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

NEW EAGLE STEP SWITCH offers a special approach to automatic process control step sequencing



Development of the Eagle step switch now provides a new approach to process control. Any type of time or sensing device can be used to advance the switch, and a multiplicity of load circuits can be operated in any combination — up to 19 circuits. Devices used to actuate the switch include: push buttons, limit switches, timer intervals, pressure change components, level control apparatus.

The new switch also provides a sequencing interlock when used with multiple indexing circuits. A mechanical circuit interlock by cam action eliminates interlocking relays. Ten ampere switch contacts control load switches direct — no need for load relays. Switch is built with 115 volt coil, and is of heavy duty industrial switch construction throughout.

Make certain you get complete information on this new switch. Send for Bulletin 780. Eagle Signal Corporation, Dept. AH-558, Moline, Illinois.

NEW PRODUCTS

on side of flaring bar help locate tube-size selector. The flaring bar and tubing are held in place and

locked by a cam. Flaring is also done with cam action.

The tool may be bench mounted or clamped in a vise and is designed for 37 and 45-degree flares.

J. and J. Mfg. and Sales Corp.
San Marino, Calif.

CIRCLE 330 ON READER SERVICE CARD

HYDRAULIC CONTROL VALVE

. . . has 40 gpm capacity

Features: Valves are available in 1, 2, 3, and 4-spool models for operating pressures to 2000 psi. Spool

types, available in any sequence, include single-acting, double-acting and float (for use on loaders, dozers, and dump trucks). Each spool has a check valve to prevent load drop when changing positions. The unit also has an adjustable built-in relief valve.

Parker Hydraulics Div.
Parker-Hannifin Corp.
Cleveland, Ohio

CIRCLE 331 ON READER SERVICE CARD

METAL O-RING
. . . is Teflon coated

Features: Effective sealing at temperatures as low as —300 deg F can be done with Teflon coated O-rings. Cold flow is eliminated by combining the resilience of the metal O-ring with the physical properties of Teflon. They are made in all standard O-ring sizes and can be used in the grooves for plain metal O-rings.

The Advanced Products Co.
North Haven, Conn.

CIRCLE 332 ON READER SERVICE CARD

AIR VALVES
. . . have interchangeable actuators

Features: Valves have brass bodies with ¼ in ports and are available in 2 or 3-way flow patterns. They feature four interchangeable actuating levers: 1. Roller lever for

cam operation; 2. Solid angle lever, actuated by a roller trip; 3. Hand lever for manual operation; and 4. Hand lockdown lever, as shown in illustration.

A. Schrader's Son
Division of Scovill Mfg. Co. Inc.
Brooklyn, N. Y.

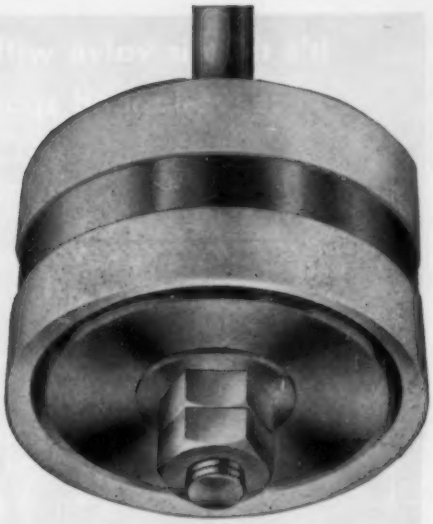
CIRCLE 333 ON READER SERVICE CARD

HYDRAULIC POWER UNIT
. . . has side-mounted reservoir

Features: Unit designed to meet all JIC requirements and has the

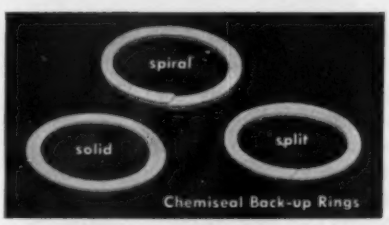
reservoir mounted on the side which keeps a head of oil on the pump at all times. This construc-

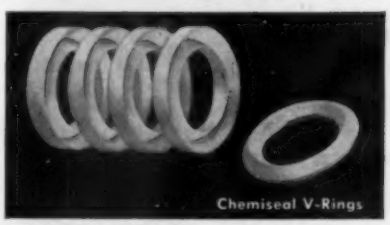
Continued on next page



CHEMISEAL PACKINGS PROVIDE

the RELIABILITY of TEFLON





TEFLON* packings are preferred by leading hydraulics engineers because they provide maximum security at vital points.

Chemiseal† packings, made of TEFLON, are chemically impervious, require no chemical inspection, have zero swelling in all hydro-carbons, new synthetic hydraulic fluids and solvents.

They offer unsurpassed anti-friction properties, are tough, resilient, non-flammable, long wearing. They have a service temperature range from minus 110° F to plus 500° F.

Have you tested the complete line of Chemiseal packings for aircraft hydraulics?

For prompt service, contact one of The Garlock Packing Company's 30 sales offices and warehouses throughout the U.S. and Canada, or write for Bulletin AD-155.

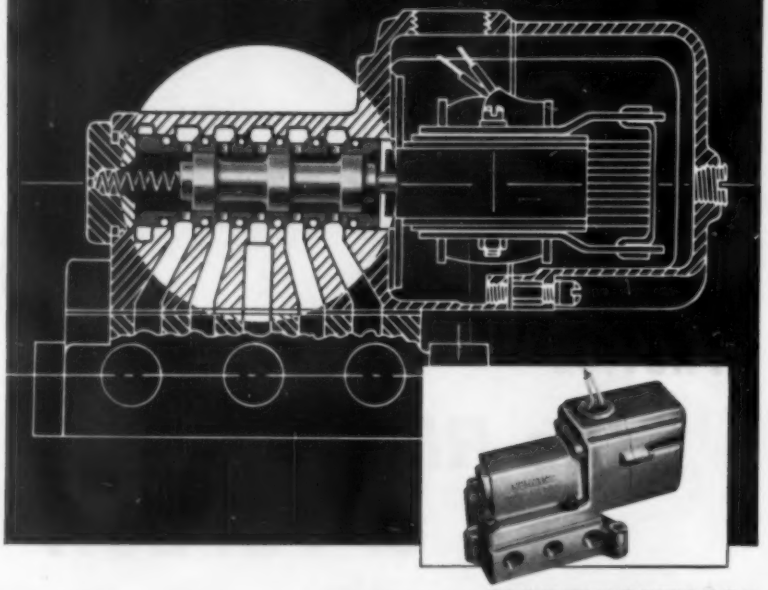
United States Gasket Company
Camden 1, New Jersey

†U.S.G. trademark
*du Pont trademark for its tetrafluoroethylene resin.

United States Gasket
Plastics Division of GARLOCK

CIRCLE 128 ON READER SERVICE CARD

It's the air valve with the floating sleeve-lapped spool design



Starts every time—INSTANTLY!

no sticking, lubrication or dirt problems

Familiar with those Monday morning epidemics of sticking valves? Never happens with Numatics air valves . . . not even after *months* of idleness. Because the patented floating sleeve-lapped spool design eliminates the major cause of sticking . . . moving elastic seals. Sealing is accomplished, instead, by the precision finish and close tolerance between spool and sleeve.

And no-stick, no-leak sealing is just one advantage of Numatics valves. Lubrication is no problem, for a Numatics valve is impervious to oil additives. They'll operate on *any* standard lubricant . . . or, they'll run dry if the application requires it. Dirt is no problem, either, because the file hard, razor sharp spool lands and orifice edges chop dirt particles to a fineness that permits passage through the valve without the slightest damage. What's it all add up to? . . . a valve that's more *reliable* and trouble-free, a valve that will last longer than any air valve now available. For complete details send for your copy of catalog #158.

NUMATICS leads the way in manifolds too

For greater efficiency, lower cost, streamline your valve installations with Numatics multiple mount manifolds. Three types available . . . individual or common exhaust and conduit . . . in 2 to 6 stations, 4 pipe sizes. SA Valves mount interchangeably, too!

NUMATICS, Inc. HIGHLAND, MICHIGAN

SALES REPRESENTATIVES FROM COAST TO COAST

NEW PRODUCTS

tion also permits the reservoir to be made from lighter gage metal.

Specifications: Available in 2000 and 5000 psi pressure ranges and capacities of 15, 30, 50, 75, 100, 200, and 300 gpm.

Rosseau Controls Ltd.
Montreal, Canada
CIRCLE 334 ON READER SERVICE CARD

HYDRAULIC PUMP . . . uses balanced vane principle

Designation: T Series

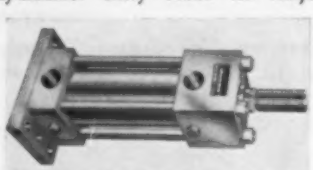
Features: Pumps are designed for 2000 psi service with capacities to 100 gpm at 1800 rpm. The vanes are balanced by allowing them to

be open at both ends to pressure on the pressure stroke, and to suction on the suction stroke. This principle allows higher volumetric efficiency over long periods of service. Pump rotation can be reversed by indexing the cam ring.

Denison Engineering Div.
American Brake Shoe Co.
Columbus, Ohio
CIRCLE 335 ON READER SERVICE CARD

AIR AND OIL CYLINDERS . . . meet JIC standards

Features: Cylinders have pressure ratings of 200 psi air and 1000 psi hydraulic. They meet all major



automotive manufacturers standards for use on machine tools, presses, transfer machines and conveyors. Cylinders are available in 9 sizes and five mounting styles, and can be furnished with or without cushions.

The S-P Mfg. Corp.
Solon, Ohio
CIRCLE 336 ON READER SERVICE CARD

Continued on page 140

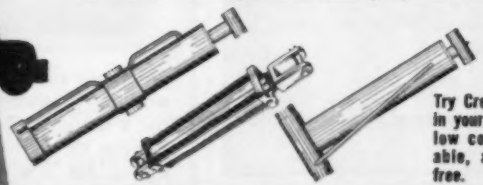
CIRCLE 29 ON READER SERVICE CARD

ON THE JOB...

with CROSS HYDRAULIC CYLINDERS

Like Cross customers everywhere, you can stay "on the job" with dependable, rugged Cross Hydraulic cylinders. Cross, the trade-mark of quality in hydraulic cylinders, is as near as your phone. For fast delivery on any quantity, built to your specifications, contact Cross Engineering Department.

Lowest Priced Engineered Quality Cylinders Available



Try Cross Cylinders in your operation... low cost, dependable, and trouble free.

CROSS MANUFACTURING CO.

LEWIS, KANSAS—EA 45525

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of Kendall— Governaire precision pneumatic

PRESSURE REGULATORS for Industry

The facts you need on a complete range of pneumatic pressure regulating valves and volume boosters. Here is your guide to a series of pilot-operated and direct acting regulators—in pipe sizes from ¼ to ⅜ and ¾ NPT...in supply pressures up to 250 psi. Fact-filled pages spell out the full story: characteristics • pressure ranges, ratios • applications—for 16 different models including motor operated and lever set types.

Write today for the new KENDALL- GOVERNAIRE catalog.

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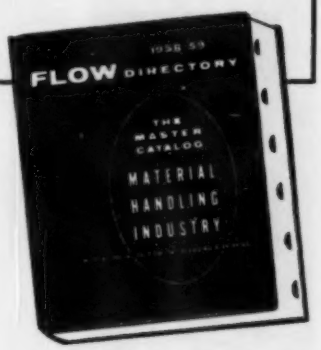
INDUSTRIAL PRODUCTS BRANCH

Route 109, West Babylon, N. Y.

A DIVISION OF FAIRCHILD ENGINE & AIRPLANE CORPORATION

Turbo-Expanders and Compressors
SPECON Variable Speed Drives and Transmissions
Pneumatic Pressure Regulators

YOUR GUIDE TO BETTER HANDLING!



THE MOST WIDELY USED REFERENCE IN THE MATERIAL HANDLING INDUSTRY

The only complete volume of authortative information about material handling, packaging and shipping equipment and accessories. Its definitions are used as standard by all enginering societies, by virtually all associations, and by military and industrial groups.

SIX CONVENIENT, THUMB-INDEXED SECTIONS FOR QUICK, EASY REFERENCE:

- Equipment and Manufacturers
- Packaging & Shipping
- Engineering and Technical Data
- Trade Name Index
- Manufacturers' Outlets and Catalogs
- Where to Buy or Rent Equipment

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FLOW DIRECTORY
812 HURON ROAD
CLEVELAND 15, OHIO

Please reserve .....copies of the 1958-59 Flow Directory @ $7.50.

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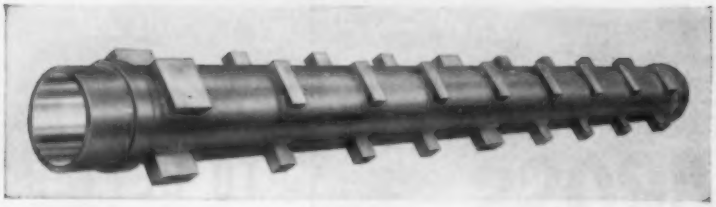
CIRCLE 8 ON READER SERVICE CARD



Let AMERICAN a Specialist, make your fluid or air powered cylinders from tubing—bars—castings or forgings to any specified physicals. Day and night, that's all we have been doing since 1918. We are equipped to meet your most exacting specifications in diameters to 16 inches and in lengths in excess of 30 feet. Weldments or integral pads supplied as required. Write or phone us for estimates.

TELEPHONE ERIE 2-3664

PRECISION INTERNAL MACHINING AHB

MANUFACTURERS OF HYDRAULIC CYLINDERS • SPINDLES • SLEEVES CLUTCH SHAFTS • PISTON RODS • RAMS • QUILLS, ETC.

AMERICAN HOLLOW BORING CO.

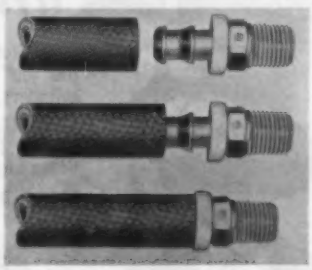
1954 Raspberry St., Erie, Pa.

NEW PRODUCTS

HOSE ENDS
. . . require no clamping

Designation: Barb-Tite

Features: The precision machining of the barbed insert assures a leak-



proof seal and is recommended for working pressures to 250 psi and has a minimum burst of 1000 psi. Fittings are re-usable and were designed for low pressure oil and air lines.

The Weatherhead Co.
Forth Wayne Div.
Fort Wayne, Ind.

CIRCLE 337 ON READER SERVICE CARD

a NEW DASHPOT...
HYDRAULIC CHECK • SHOCK ABSORBER

Airoyal now offers a complete line of pull-type Dashpot Cylinders. These are available in 3 sizes, for pull loads of 480, 1200 and 3000 pounds. Standard strokes for each size are 2", 4" and 6".

Features:

- May be mounted in any position
- Low controlled-speeds
- High return-speeds
- In-line integral oil reservoir

Dashpot Cylinders carry the standard Airoyal guarantee: they are unconditionally guaranteed against breakage—forever!

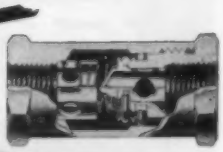
THE AIROYAL MFG. CO.

FLUID POWER EQUIPMENT

1990 SPRINGFIELD AVENUE
MAPLEWOOD, NEW JERSEY

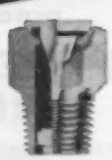
CIRCLE SEAL VALVES
provide proven 100% reliability...

Check Valves



Inline Relief Valves

Popoff Relief Valves



Shutoff Valves

CIRCLE SEAL

These and other standard and special valves are available for virtually all of your exacting service requirements.

Complete engineering data available. Write today!

CIRCLE SEAL PRODUCTS COMPANY, INC.
2181 East Foothill Boulevard
Pasadena, California

See Our Catalog in Sweet's Product Design File

CIRCLE 6 ON READER SERVICE CARD

CIRCLE 22 ON READER SERVICE CARD

LIMIT SWITCHES
. . . have high electrical capacity

Features: Two types available, a roller-plunger-actuated and an in-line plunger-actuated. Both are

completely sealed and are resistant to abuse and wear.

Specifications: Electrical rating, 10 amp for 120, 240, or 480 v ac; .8 amp at 115 v dc; .4 amp 230 v dc; .1 amp at 550 v dc.

Micro Switch Division,
Minneapolis-Honeywell Regulator Co.
Freeport, Ill.

CIRCLE 338 ON READER SERVICE CARD

Oops—a Boo boo—Sorry!

Due to a printer's error, the wrong cylinder illustration was shown in the Sheffer Corporation advertisement on page 90 in the March issue of APPLIED HYDRAULICS.

The right copy showing the right "interchangeables" is shown in the Sheffer advertisement on page 143 of this issue.

SOLENOID VALVES
. . . have molded waterproof coils

Designation: Type M

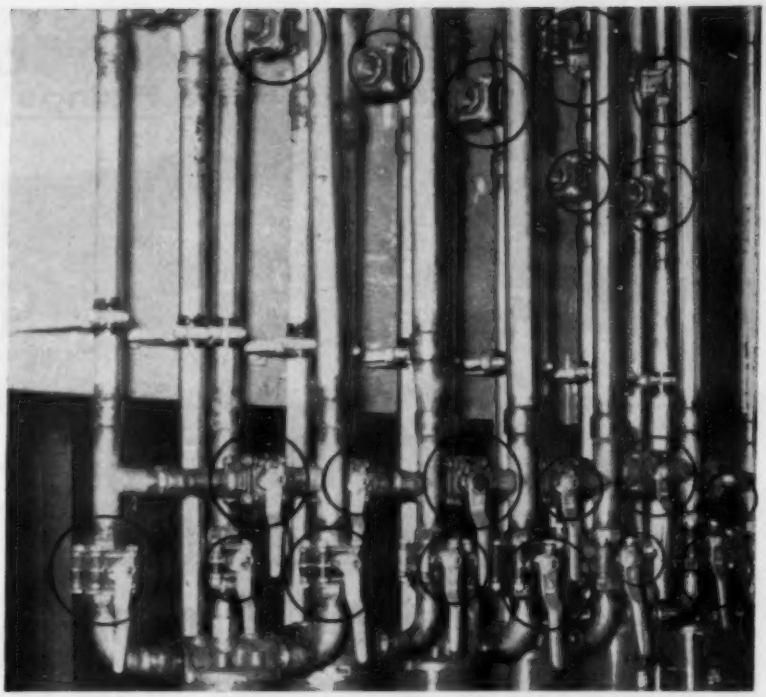
Features: Valves are 2-way, piston pilot operated and are designed for

pressures to 400 psi and temperatures to 340 F. They are packless and have unbreakable piston rings. Available in sizes ⅜ to 3 in.

J. D. Gould Co.
Indianapolis, Ind.

CIRCLE 339 ON READER SERVICE CARD

Continued on next page

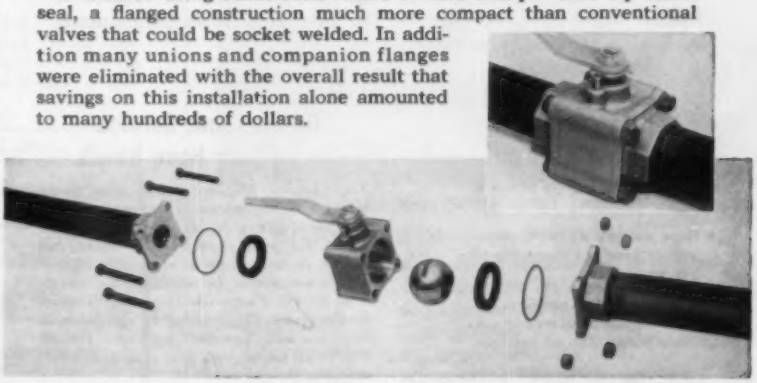


Only the ECON-O-"MISER" Ball Valve was able to solve this problem for PathéColor, Inc.

THE PROBLEM: To find a valve that would meet all of the following requirements:

1. Quick visual indication of position and quarter turn operation. 2. Excellent flow characteristics and positive shut-off. 3. The advantages of flange construction without the bulk and weight of conventional flanged valves. 4. Easy & quick disassembling for low cost maintenance. 5. The most compact and economical installation of Type 316 stainless steel valves possible.

SOLUTION: *Specifying* and *installing* Worcester's Econ-o-"miser" Ball Valve. In so doing PathéColor found a valve that provides a positive seal, a flanged construction much more compact than conventional valves that could be socket welded. In addition many unions and companion flanges were eliminated with the overall result that savings on this installation alone amounted to many hundreds of dollars.



Valves available, ¼"-2", in following standard materials*: Bronze, Aluminum Bronze, Aluminum, Carbon Steel and Types 303 and 316 Stainless Steel. Standard Seat and O-Ring materials*: Buna-N, Neoprene, and Teflon.

**Other materials available on request.*

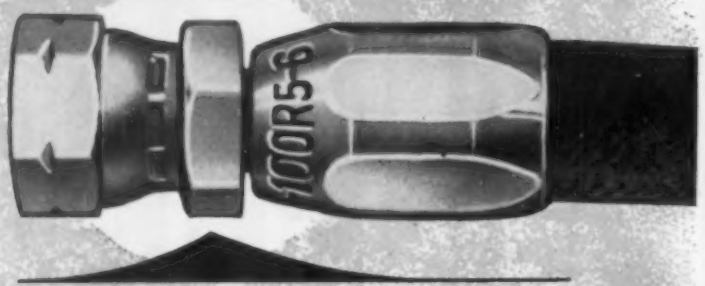
For further information and descriptive literature write to:

WORCESTER VALVE CO., INC.

16 PARKER STREET • WORCESTER, MASS.

CIRCLE 148 ON READER SERVICE CARD

Save Time and Money
with Flexon Reusable Hose Fittings



ALL FLEXON REUSABLE FITTINGS now equipped with Easy Grip Hex for simple, speedy attachment

There's no longer any need to struggle with special tools when you attach reusable hose fittings. Now you can attach reusable fittings the easy way . . . if the fittings are FLEXON.

Every FLEXON reattachable fitting—male or female—has a hex on the stem. You can get a good grip on the fitting with an ordinary wrench for faster, easier insertion into the hose. And there's no danger of damaging the threads or of damaging the seat of female couplings.

For your hose connector requirements where the serviceability of reusable fittings is desired, improve that serviceability by specifying FLEXON Reusable Fittings with the Easy Grip Hex. Sizes start at 3/16" hose I.D.

For all your hose assembly requirements take advantage of Flexon know-how. It may be the first step towards reducing your over-all fluid power costs.

Flexon offers the Complete Line

- Bulk hose in a wide range of types and sizes.
- Hose assemblies with standard or special fittings for all pressures.
- A full line of crimped, reusable, swaged, push-on and special fittings, for all services.

On-The-Spot Service for all Your Hose Needs

Your nearby Flexonics field man is as near as your telephone to give you prompt, competent service on all your flexible hose needs. For your further convenience, his service is backed by strategically located warehouse stocks. In addition, the assistance of the Flexonics Hose Application Engineering Department is available to help you with "special" problems. Get all your hose needs from this single, dependable source.

Flexonics Corporation RH-10

Mr. Flexon identifies products of Flexonics Corporation that have served industry for over 56 years.

1385 S. Third Avenue • Maywood, Illinois
In Canada: Flexonics Corporation of Canada, Ltd., Brampton, Ontario
Manufacturers of metal and rubber hose, expansion joints, metallic bellows and aircraft components.

CIRCLE 39 ON READER SERVICE CARD

NEW PRODUCTS

HYDRAULIC PUMP . . . is mounted integral with motor

Designation: Model 1203-152D

Features: Pump and motor was designed for supplying pressure to hydraulic actuators on a radar antenna in ground based equipment. Motor has thermal protection with automatic reset. Pump has an aluminum body, anodized finish, and case-hardened gears and shaft.

Specifications: Flow of 1 gpm at 300 psi and 5400 rpm. Current, 208 v, 400 cycle, 3 phase.

Eastern Industries Inc.
Hamden, Conn.

CIRCLE 340 ON READER SERVICE CARD

4-WAY VALVES . . . priced for OEM

Features: Valves are low priced and incorporate the shear-seal principle to prevent internal and external leakage. A ball type handle is used and can be furnished with spring centering or spring offset. Parts are stainless steel and aluminum.

Specifications: Valves are available in 1/4, 3/8, and 1/2 in, NPT sizes and have a rated flow of 7 to 15.5 gpm at a velocity of 20 fps.

Barksdale Valves
Los Angeles, Calif.

CIRCLE 200 ON READER SERVICE CARD

CIRCLE 63 ON READER SERVICE CARD

SAVE...up to 50%

with this "FINEST of the INTERCHANGEABLES"!

C5 Series

- 250 psi Air—to 2500 psi Hydraulic
- 11 Bore Sizes—1⅛" to 14"
- Cartridge Quickly Removed Without Disassembly
- Sturdy Steel Head Construction
- Meets or Exceeds J.I.C.
- Interchangeable with Other Makes

Write, NOW, for Bulletin #558

SHEFFER PNEUMATICS HYDRAULICS

THE SHEFFER CORPORATION

Cincinnati 15, Ohio • Phone: VAlley 1-0320

Manufacturers of the industry's most complete line of air and hydraulic cylinders

SOLD BY LEADING DISTRIBUTORS NATIONWIDE

CIRCLE 11 ON READER SERVICE CARD

This is the Air Cleaner That Requires NO MAINTENANCE

- Removes oil and moisture from air lines without filters or screens
- Revolutionary design eliminates all moving parts
- Nothing to maintain
- Low-cost—Lists from $16.50 up
- Virtually 100% efficiency in removing pipeline entrainment
- No loss of pressure
- Reduces maintenance of pneumatic equipment
- Prolongs life of air tools

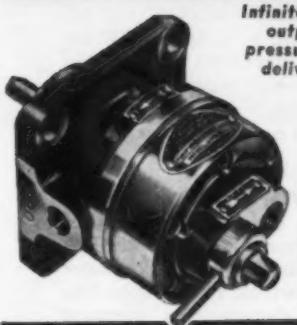
ANDERSON Hi-eF PURIFIERS

FREE Send for complete catalog on these astounding air cleaners. Mail reader service card for your complimentary copy of Bulletin 502.

THE V. D. ANDERSON COMPANY

1936 West 96th Street, Cleveland 2, Ohio

SAVERY ANNULAR PISTON PUMP



Infinitely variable from maximum output down to zero. Working pressures up to 1500 p.s.i. Fixed delivery models also available.

This compact rotary pump without Gears, Valves, Vanes or Springs is of unique design and simple in construction.

We are exhibiting at the Universal Exhibition in Brussels. April 17th-October 19th.

The pump has the following desirable characteristics:

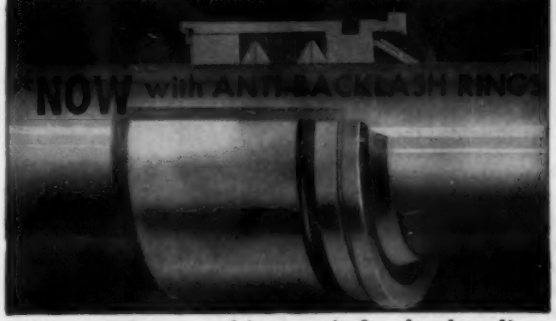
- Volumetric efficiency as high as 99%
- Absolute positive action and steady uniform flow at slow speeds
- No aeration or turbulence of the fluid
- The path of the fluid through the pump is unidirectional and the internals are constantly swept by the fluid
- No idle pockets or passages to cause air locks or allow coagulation
- Completely self-lubricating, ensuring capacity to run for long periods without attention
- Leakproof

U. S. and CANADIAN AGENT

DAVIES BROS., GLADSTONE, NEW JERSEY

Thomas Savery Pumps Ltd., Birmingham, England

THE ORIGINAL MONOPAK—CARTRIDGE



A complete packing unit for hydraulic or pneumatic rods or cylinders.

**Detailed literature on request.*

- **Easily installed or replaced.**
- **Needs no adjusting.**
- **Reduces initial machining expense.**
- **Longer service life.**
- **Includes "Seal-Guard" rod wiper.**
- **Low friction coefficient.**
- **Shock and burst proof.**
- **Cuts machine down-time.**

HYDRAULIC ACCESSORIES CO.

24301 Hoover Rd. Van Dyke, Mich.

CIRCLE 105 ON READER SERVICE CARD

CIRCLE 54 ON READER SERVICE CARD

TWO MAGNETS

that help keep a Fluid Power System Operating Efficiently

Two powerful Alnico permanent magnets which energize the stack of grids in each

FERROFILTER

MAGNETIC SEPARATOR

As a result, Frantz FERROFILTERS extract microscopic steel particles resulting from abrasion and wear of moving parts; steel burrs and other ferrous particles. FERROFILTERS help prevent sticking and non-functioning of valves, pistons and other precision parts.

Low pressure FERROFILTERS 1" and under made this way. Other low pressure models to 8" pipe size. High pressure models to 5000 psi. also available.

Write us for BULLETIN PM-65

S. G. FRANTZ CO., INC.

Brunswick Pike & Kline Ave.

P. O. Box 1138 Trenton 6, N. J.

USEFUL LITERATURE

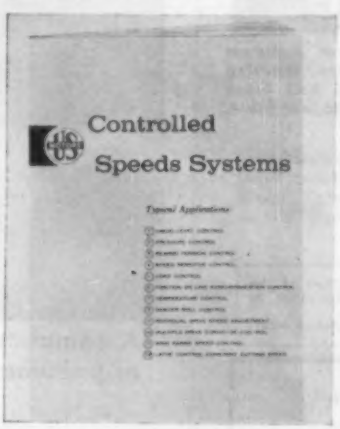
PRESSURE REDUCING VALVE . . . that uses a sliding gate opening and closing an orifice to regulate pressure is illustrated in a folder from *Jordan Corp., Cincinnati, Ohio.* Folder includes dimensions and flow curves for sizes from ¼ to 2½ in and inlet pressures to 300 psi air, water or oil.

CIRCLE 415 ON READER SERVICE CARD

RELAYS . . . which are not effected by 60-g shock are described in a 4-page bulletin prepared by *Struthers-Dunn, Inc., Pitman, N. J.* The folder lists all specifications, including vibration tests of 2000 cycles at 30 g without chatter. Hermetically sealed relay contains six double-throw contacts which have a rating of 2 amp at 26.5 volts dc.

CIRCLE 416 ON READER SERVICE CARD

CONTROLLED SPEED SYSTEMS . . . are described and illustrated in an 8-page bulletin issued by *U. S. Electrical Motors Inc., Los Angeles, Calif.* The booklet provides information for maximum



efficiency in controlled speed systems. Typical applications are detailed, including those for control of liquid level, pressure, rewind tension, speed, and temperature.

CIRCLE 417 ON READER SERVICE CARD

SOLENOID PILOT VALVE . . . having a capacity of 17 cu in per min that can operate at pressures to 3000 psi is described in a data sheet prepared by *Sarasota Precision Products Inc., Sarasota, Fla.* Data sheet contains complete specifications and dimensions of this 2-way valve.

CIRCLE 418 ON READER SERVICE CARD

TIMING BELT DRIVES . . . are described and illustrated in a 68-page catalog available from *Morse Chain Co., Ithaca, N. Y.* It gives complete engineering information on all five basic timing belt pitches. The catalog, TB-58, explains how the belts' accurately spaced teeth engage sprockets, and do not depend on friction to transmit power. This construction eliminates heat build-up and gives high efficiency.

CIRCLE 419 ON READER SERVICE CARD

COMPRESSED AIR SEPARATORS . . . for the removal of moisture from air lines are covered in a 4-page folder prepared by *Jas. A. Murphy & Co., Inc., Hamilton, Ohio.* The separators use three means of moisture removal, expansion, centrifugal force, and surface attraction. Their internal assemblies are non-corrosive.

CIRCLE 420 ON READER SERVICE CARD

SUPER-ALLOY TUBING . . . for strength at high temperatures is detailed in bulletin 70 published by *Superior Tube Co., Norristown, Pa.* The materials listed as super alloys are those which will not rupture under a stress load of 25,000 psi at 1200 deg F. Graphs show the ultimate strength and yield strength at high temperatures for 8 of the alloys.

CIRCLE 421 ON READER SERVICE CARD

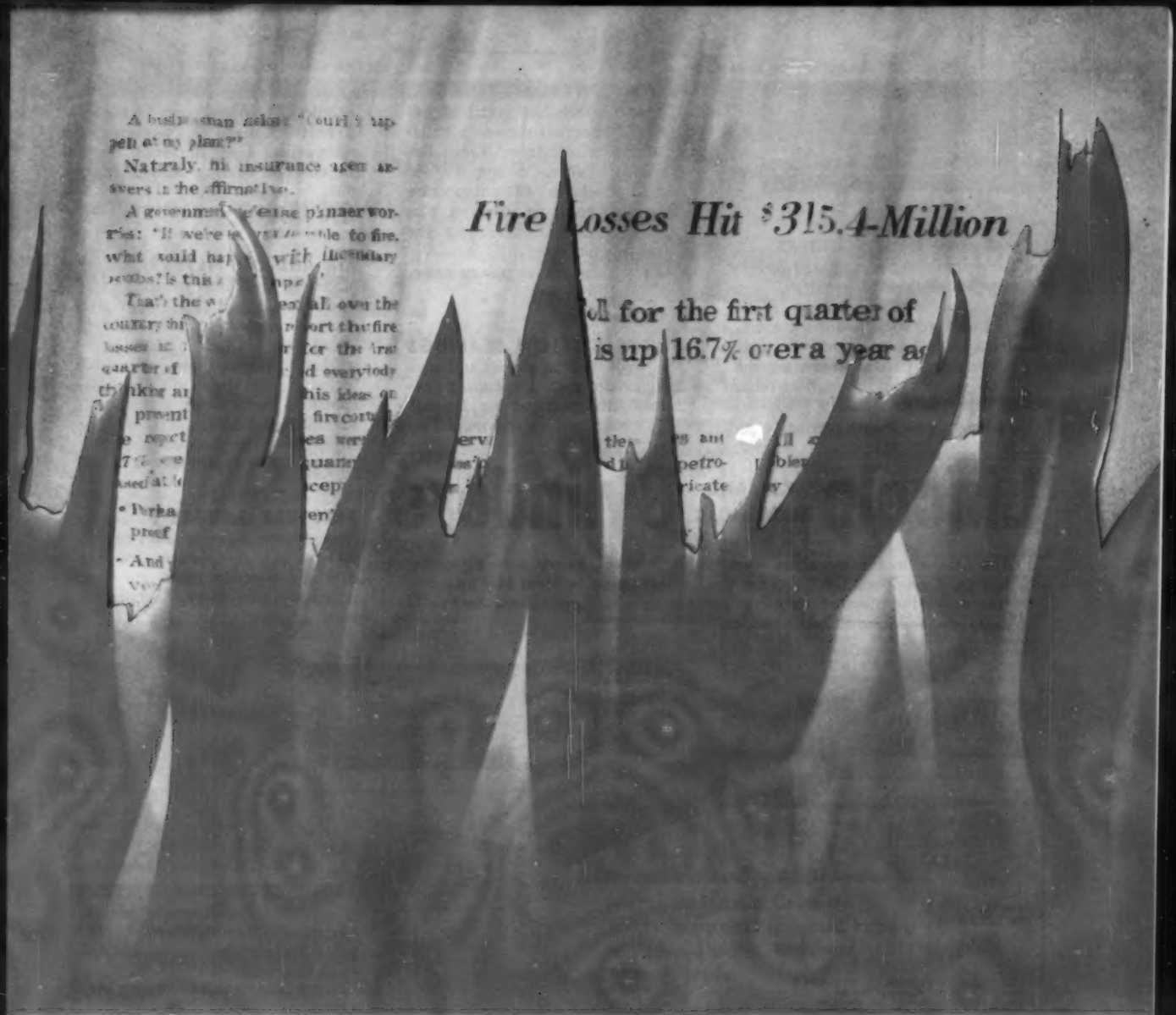
LIMIT SWITCHES . . . are described in a 4-page data sheet available from *Micro Switch Div., Minneapolis-Honeywell Regulator Co., Freeport, Ill.* Photographs, line drawings, characteristics, electrical ratings, and prices are included in the data sheet.

CIRCLE 422 ON READER SERVICE CARD

SMALL VALVES . . . for use in hydraulics, instrumentation, and chemical processing are shown in catalog MV-957 issued by *Hoke, Inc., Englewood, N. J.* It lists dimensions and flow curves for the company's line of needle, globe, and check valves.

CIRCLE 423 ON READER SERVICE CARD

Continued on page 146



Plan against it . . . not for it!

Cellulube fire-resistant hydraulic fluids and synthetic lubricants open up new areas of in-plant fire prevention

The stakes are high—personnel, equipment, production, reputation. No one has better reasons than industry has to plan against fire.

And with today's advances in chemistry, industry has never had more effective and specialized materials with which to do just that.

Cellulube fire-resistant hydraulic fluids and synthetic lubricants are good examples. In hydraulic equipment, they reduce the danger of uncontrollable fire caused by line breaks or other failures when flammable fluids are in use. In air compressors, these non-petroleum oils not only prevent excessive carbon formations—the main source of fire and violent explosion—but also meet the severest of lubrication requirements.

Minimizing the hazards of industrial operations through development of fire-resistant Cellulubes . . . making these functional fluids available in 6 controlled viscosities for broader application . . . this is another example of Celanese research and product development at work hand-in-hand with industry.

Celanese Corporation of America, Chemical Division, Dept. 588-E. 180 Madison Avenue, New York 16.

Celanese® Cellulube®

Basic reasons . . . . . for improved products

Acids	Functional Fluids	Polyols
Alcohols	Gasoline Additives	Plasticizers
Aldehydes	Glycols	Salts
Anhydrides	Ketones	Solvents
Esters	Oxides	Vinyl Monomers

Celanese CHEMICALS

Agricultural	Paper
Automotive	Pharmaceutical
Aviation	Plastics
Building	Surface Coatings
Electrical	Textiles

USEFUL LITERATURE

AIR AND OIL CYLINDERS . . . are described and illustrated in two separate catalogs prepared by *Teer-Wickwire & Co., Jackson, Mich.* manufacturers of Lindberg cylinders. One catalog gives complete engineering information on the 2000 psi oil cylinders and the other on 150 psi air cylinders.

CIRCLE 424 ON READER SERVICE CARD

FLOW CONTROL VALVE . . . designed to regulate speed of hydraulic cylinders is shown in bulletin 275 available from *Hanna Engineering Works, Chicago, Ill.* The bulletin includes all engineering and dimensional information plus cutaway views explaining the valve's operation.

CIRCLE 425 ON READER SERVICE CARD

ANTI-FRICTION BEARINGS . . . with unusual shapes and sizes designed for special operating conditions are described in Bulletin AFB-2 prepared by *Industrial Tectonics, Inc., Ann Arbor, Mich.* It includes illustrated case histories of bearings made to customer requirements. Line drawings show the range of bearing designs available.

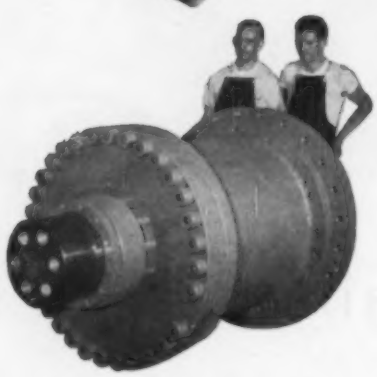
CIRCLE 426 ON READER SERVICE CARD

Lincoln AIR AND HYDRAULIC Cylinders

The answer to the increased demand for rugged, heavy duty air and hydraulic cylinders. Designed for the hardest usage in Steel Mill operation or for the hundreds of other modern cylinder applications that require dependable efficient service.

HYDRAULIC RAM
168" Stroke—10"
Stainless Steel Rod
1000 PSI Oil Pressure
For Aluminum Ingot Lift
On D. C. Casting Units

WRITE FOR NEW COMPLETE CATALOG



HYDRAULIC CYLINDER
32" Bore—24" Stroke
2000 PSI Oil Pressure
Lifting Capacity Equals
1,600,000 lbs.
For Oil Shale Retorts.

JACK CYLINDERS
For Mining Operation
10" Bore—140" Stroke
2000 PSI Oil Pressure

Lincoln MACHINE CO. INC.

P. O. Box 272 EDgewood 2-4689 Salem, Ohio

AIR AND OIL FILTERS . . . are illustrated in a new 16-page catalog published by the *Fram Corp., Providence, R. I.* The new catalog, which has been completely reworked, condensed, and simplified, includes illustrations, diagrams, dimensions, rated flows, and mounting information on all oil and air filters made by the company.

CIRCLE 427 ON READER SERVICE CARD

PRESSURE GAUGES . . . with ranges from 30 in vacuum to 20,000 psi plus complete engineering data and selection tables are illustrated in a new 48-page catalog released by *Kunkle Valve Co., Fort Wayne, Ind.* Gauges are for air, oil, and other liquids and have bourdon tubes made of bronze or stainless steel.

CIRCLE 428 ON READER SERVICE CARD

DOUBLE-STROKE INDEX ADAPTER . . . that can be installed on any Ross Skyline valve is covered in a folder released by *Ross Operating Valve Co., Detroit, Mich.* The folder shows four typical air circuits where the adapter was used to advantage in converting valves to momentary action.

CIRCLE 429 ON READER SERVICE CARD

CUP PACKINGS . . . are illustrated in a 4-page folder titled VIX-SYN. Included are application notes and a table of maximum clearances between packing follower plates and cylinder walls, plus a listing of all standard cup packing sizes. Folder is available from *E. F. Houghton & Co. Philadelphia, Pa.*

CIRCLE 430 ON READER SERVICE CARD

Continued on page 148

CIRCLE 20 ON READER SERVICE CARD

HYDRAULIC ENGINEERING FOR INDUSTRY

CARDWELL

TRADEMARK SINCE 1829

DESIGN SERVICES
FABRICATION
POWER UNITS
HYDRAULIC PANELS
ELECTRICAL CONTROL PANELS
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Complete Engineering and Design Services Are Available. Qualified Sales and Service Engineers in Most Areas.

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Quality — A CARDWELL TRADITION SINCE 1829
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Now . . . for the first time—
A FLUID POWER TRAINING PROGRAM
to fill industry's need for trained personnel

Hitchcock's NEW "job-related" home study course "INSTALLATION, OPERATION and MAINTENANCE of FLUID POWER EQUIPMENT

An up-to-date practical course of study covering Theory, Fundamentals of operation, Application, Diagnosis and Repair for all types of hydraulic and pneumatic equipment and controls.

The problem of developing properly trained, qualified personnel to install, operate and maintain FLUID POWER EQUIPMENT becomes greater day by day. Design simplification and "advanced mechanization" continually expands and increases the uses of FLUID POWER to increase production and operating efficiency in all phases of industry.

Hitchcock Publishing collaborated with two of the nation's leading fluid power authorities to develop this program. Now, men can be trained "on-the-job" through home-study and daily direction in the development of practical skills in fluid power.

Hitchcock's course is available to company sponsored group enrollments or individuals on a low-cost basis in a convenient, practical 18 chapter study course. Upon completion of the course, students will attend a 2 day work-shop session for practical review, application and discussion of the material covered.

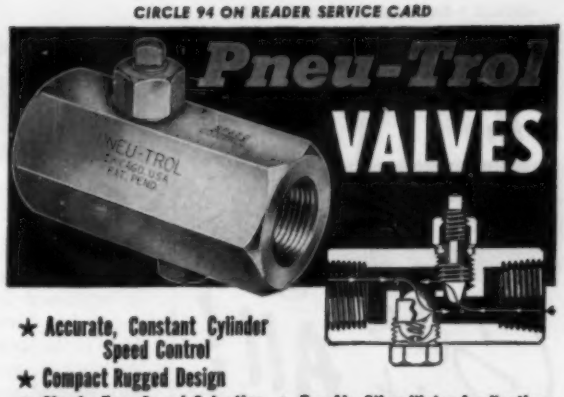
Investigate **the advantages of Hitchcock's FLUID POWER home-study course for training individuals to fill your fluid power personnel needs. You'll benefit through increased production and operating efficiency. Send for complete information and enrollment forms today !**

HITCHCOCK Publishing Company / Dept. of Training & Education, Industrial Services Division, 222 E. WILLOW AVE., WHEATON, ILLINOIS

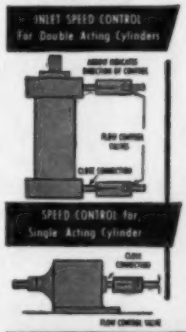
CIRCLE 58 ON READER SERVICE CARD

CIRCLE 94 ON READER SERVICE CARD

Pneu-Trol VALVES



★ **Accurate, Constant Cylinder Speed Control**
★ **Compact Rugged Design**
★ **Simple, Easy Speed Selection** ★ **For Air, Oil or Water Applications**



Pneu-Trol Speed Control Valves, are widely used in hundreds of control applications because they combine in a short, compact body, a tapered fine thread needle for extremely accurate air or oil flow control and a floating retro ball check, which permits full flow in the opposite direction. Retro ball floats in most sensitive position to its seat, requiring only a slight differential pressure to fully open or close it.

Needle design permits maximum flow capacity in the controlled direction. Metal to metal needle and ball seats insure long trouble-free service. Simple, practical "O" gland structure eliminates troublesome leaking. Valve bodies machined from hex brass or aluminum for 2000 psi working pressures; steel and stainless steel for 5000 psi. Made in 5 female pipe sizes—⅛" to ¾". ATTRACTIVE PRICES . . . IMMEDIATE DELIVERY.

Write for illustrated circular and prices.

Pneu-Trol DEVICES, INC.
1426 N. KEATING AVENUE • CHICAGO 51, ILL.

CLOSURES

- **Metal or Plastic Caps or Plugs to protect threads, tubes, machined parts, reamers, cutters, tools.**
- **Protect against thread damage, dust, dirt, and moisture.**
- **For inside and outside application. All sizes. Immediate delivery.**

Clover closures are made in metal and tough plastic polyethylene. They are made in caps, plugs and special shapes to fit parts tightly, offering completely sealed protection during manufacture, shipping and storage. Backed by years of closure experience. Write for low prices and complete information.

METAL
Threaded caps for AN & SAE external threaded parts.

PLASTIC
Tapered parts for use either as a cap or plug.

METAL
Threaded plugs for AN or SAE internal threaded parts.

PLASTIC (L.T. Series)
Non-threaded push-on caps for tubing, AN & SAE Fittings, reamers, etc.

Send coupon today !

Gentlemen:
Please send samples and prices of closures in
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CIRCLE 25 ON READER SERVICE CARD

CIRCLE 1 ON READER SERVICE CARD

only the **Fall** Gets it All!

CLOSED JOINT

WHY be satisfied with only partial removal of dirt or other foreign accumulation from piston rods when you can—

Remove ALL the Dirt from Rod O.D. Stop Dirt Passing Through the Ring Joint with a

Fall "CJ" WIPER RING

The Ring with a Closed Joint! SPRING LOADED with Squeeze Grip Action

If you have a wiper ring problem write, wire or phone us.

All Fall Rings are covered by patents issued or patents pending.

ACE PRODUCTS CO., Toledo 1, Ohio Phone Cherry 3-6513

You Can Depend on ACE Products—Established 1935!

USEFUL LITERATURE

CENTRAL COMPRESSOR SYSTEM . . . for supplying air, helium, or nitrogen at 12,000 psi is explained in bulletin 100 prepared by *Cardox Corp., Chicago, Ill.* The bulletin illustrates many of the package systems including both mobile and stationary units.

CIRCLE 431 ON READER SERVICE CARD

HYDRAULIC TUBING . . . formed by resistance welding is detailed in a 10-page bulletin released by *Republic Steel Corp., Steel and Tubes Div., Cleveland, Ohio.* The bulletin gives tips on bending and flaring the tubing and contains a complete list of specifications and recommended working pressures.

CIRCLE 432 ON READER SERVICE CARD

LARGE INDUCTION MOTORS . . . by the *Louis Allis Co., Milwaukee, Wisconsin,* are described in Bulletin No. 1950. Information on full line of motors in ratings from 150 to 1250 hp is given. Cutaway drawings show the protection offered by various motor enclosures. Also discussed are bearings, insulation and optional features.

CIRCLE 433 ON READER SERVICE CARD

AIR DRYERS . . . designed to remove water vapor from air lines are shown in a 4-page booklet issued by *George W. Leseman and Co., Torrance, Calif.* Included is a chart of costs for the use of dry air and wet air. Illustrations include application photographs and flow diagrams.

CIRCLE 434 ON READER SERVICE CARD

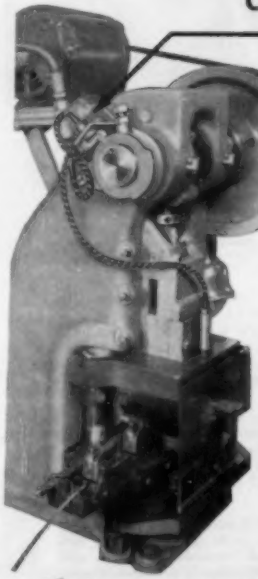
WELDING FITTINGS . . . and flange weights are listed on two data cards available from *The Tubular Products Div., The Babcock and Wilcox Co.,* Beaver Falls, Pa. Data card FDC-251 furnishes weights of various sizes and types of forged steel flanges and card FDC-250 lists the weights of 8 types of welding fittings in sizes to 36 in.

CIRCLE 435 ON READER SERVICE CARD

Write...for this valuable NEW Catalog Bulletin

SPAN BRASS MFG. CO. INC. OTSEGO, MICHIGAN

How to SAVE Your BREATH, MONEY, and do CLEANER PUNCH WORK!



Compressed air, the "breath" of many industrial processes, costs money when wasted, and sometimes, if not used properly, doesn't do the job it could.

For example, on the automatic punch press at left, a continuous stream of air was used originally to keep dies clean. After installing a Clippard Miniature 2-way Air Valve cycled to JET BLAST die scrap between each stroke, work quality was improved, production speeded and air saved.

Clippard Miniature Air Valves (2 and 3-way), Cylinders (many types and strokes) and accessories can save air and money for YOU, and improve your tooling, jigs, fixtures and automated production devices, simply and inexpensively.

Visit us at Booth 231 Automation Show, June 9-13

Clippard INSTRUMENT LABORATORY, INC.

7382-H Colerain Rd., Cincinnati 39, Ohio • Phone: JAckson 1-4261

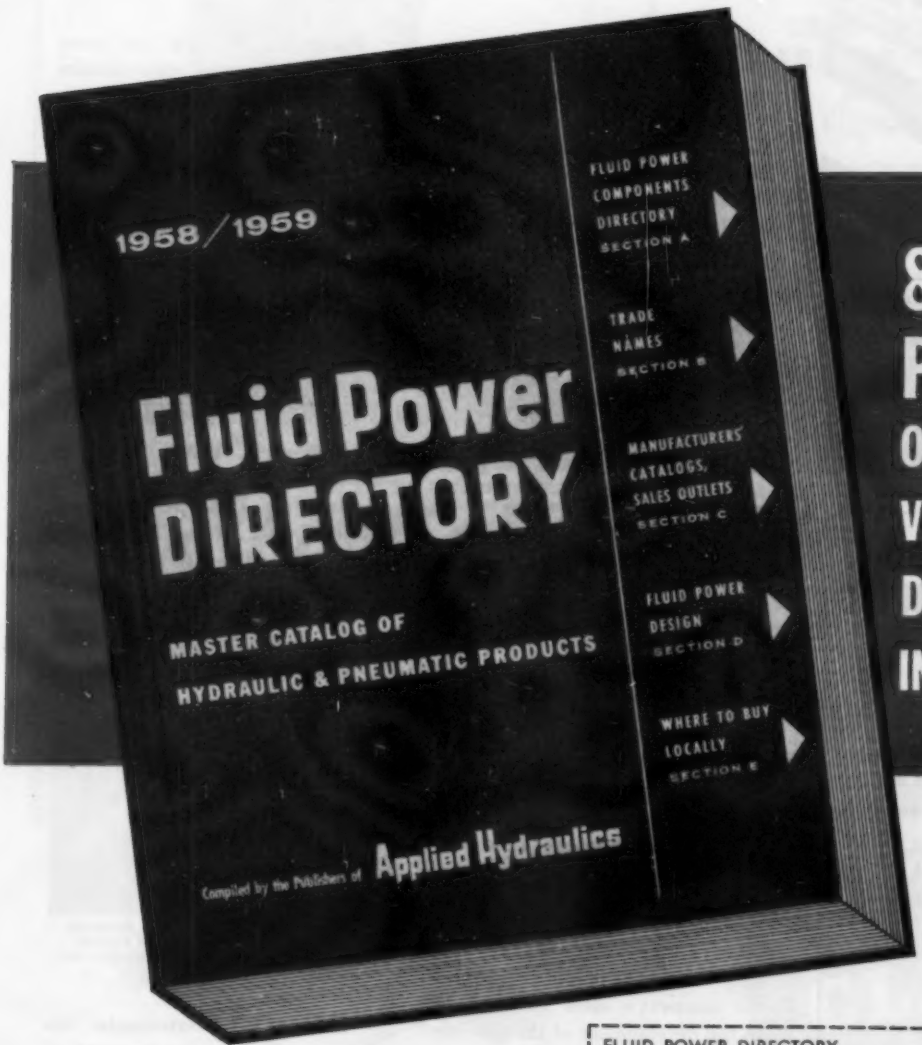
Manufacturers of R. F. Coils, Electronic Equipment, Miniature Pneumatic Devices

CIRCLE 114 ON READER SERVICE CARD

CIRCLE 24 ON READER SERVICE CARD

COMPLETE GUIDE

TO FLUID POWER . . . *helps you design and use oil and air circuits.*


1958/1959
Fluid Power DIRECTORY
MASTER CATALOG OF
HYDRAULIC & PNEUMATIC PRODUCTS
FLUID POWER COMPONENTS DIRECTORY SECTION A
TRADE NAMES SECTION B
MANUFACTURERS' CATALOGS, SALES OUTLETS SECTION C
FLUID POWER DESIGN SECTION D
WHERE TO BUY LOCALLY SECTION E
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812 HURON ROAD, CLEVELAND 15, OHIO

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Designs to 20,000 PSI
With or Without Reservoir

160 Cubic Inch Reservoir with 8" x 8" Base Plate. Optional Size Piston: ⅜", ½", ¾", 1".

Handle length: 18 inches
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The single pump with ½", ¾", 1" or 1½" piston now available in stainless steel.

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Hydraulic Hand Pumps for 1001 Uses
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POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Joe R. Hames has been appointed district sales manager for **Roper Hydraulic Inc.,** Rockford, Ill. covering New Mexico, Texas, Oklahoma, Arkansas, and Louisiana. He has been traveling this area as a Roper representative for the past 12 years.

Joe R. Hames
Roper Hydraulics Inc.

W. C. Musham
Imperial Brass Mfg. Co.

W. C. Musham was elected president and treasurer of **Imperial Brass Mfg. Co.,** Chicago, Ill. He succeeds F. C. Shafer, who remains chairman of the board of directors.

The Sheffer Corp., Cincinnati, Ohio and **The Hein-Werner Corp.,** Waukesha, Wis. have appointed **F. Somers Peterson Co.** as their west coast representatives. With offices in San Francisco and Los Angeles, Calif., Peterson will handle Calif., Arizona, and Nevada. **Ellis Bidwell** joined the company's sales force to aid in the development of the recently formed hydraulics division.

Denison Research Foundation announced the appointment of **David W. Deamer** as chief hydraulic research engineer; **Dr. Walter J. Frajola** as supervising consultant, physiological chemistry; and **Paul O. Schumann** as research asssitant.

Paul W. Welch has been named New England regional sales manager for **Sealol Corp.,** Providence, R. I. He has been with Sealol since 1951.

Hydro-Line Mfg. Co., Rockford, Ill. has appointed two new sales representatives. Western Michigan will be covered by **Everett Adams,** and the states of Alabama, Tennessee, North and South Carolina, Georgia, and Florida will be covered by **J. A. Postell.**

Herbert H. Upton has been appointed general manager of the **Hydraulics Div., Brown and Sharpe Mfg. Co.,** Providence, R. I. He continues to serve in his former capacity as president of Double A Products Co. **Borge Rosaen** also joins the Hydraulics Div. as its general sales manager.

Herbert H. Upton
Hydraulics Div., Brown & Sharpe Mfg. Co.

T. H. Brumagin
Ajax Flexible Coupling Co., Inc.

Thomas H. Brumagin has become general sales manager of the **Ajax Flexible Coupling Co. Inc.,** Westfield, N. Y. He has been associated with Ajax for 11 years in engineering, production, and sales.

Mechanical Air Controls, Detroit, Mich. has appointed five

Continued on page 152

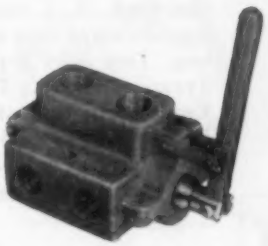
CIRCLE 51 ON READER SERVICE CARD

DOUBLE SELECTOR VALVE

GRESEN HYDRAULICS

A NEW GRESEN PRODUCT NOW AVAILABLE

Model DS-75



FEATURES: Cast iron body—pressure balanced spool—Easy to mount—Chrome plated spool—Optional three handle positions.

SPECIFICATIONS: Capacity—24GPM @15 ft/sec.
Pressure range—0 to 1500 PSI
All openings—¾" NPT
Shipping weight—12 lbs.

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GRESEN MANUFACTURING CO.

405-35 Ave. N. E. Dept. AH-58 Minneapolis 18, Minn.

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2567

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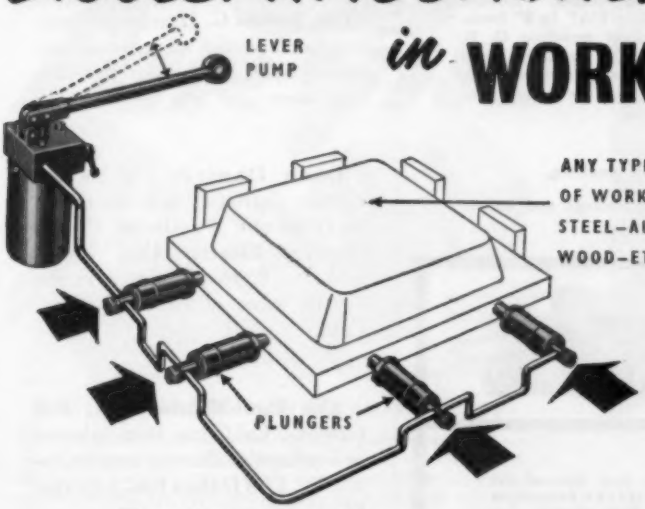

These plungers can exert a pressure of from 800lbs—4 tons.
Can be used in groups of any number.

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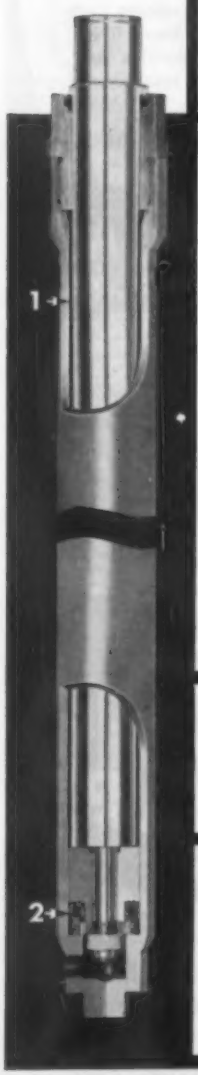
CIRCLE 95 ON READER SERVICE CARD

POST SCRIPTS OF INDUSTRY

new sales organizations. They include: **Fluid Power Engineering Co.,** Cleveland and Cincinnati, Ohio; **N. B. Cochrane Co.,** Baltimore, Md.; **Machinery and Machine Supplies Co. Inc.,** New York City; **Walter Norris Engr. Co.,** Chicago, Ill.; and **L. S. Tarshis and Sons, Ltd** Montreal, Canada.

Control Equipment Co., Atlanta, Ga. has opened a sales office in Orlando, Fla. **H. J. Hoffman,** formerly with Wheelco Div., Barber Colman Co. will be in charge of the office and will handle Florida sales of Cuno Engineering Corp., along with other lines of automatic control equipment.

Good Design Deserves . . .
BHEW Custom-Built
HYDRAULIC CYLINDERS



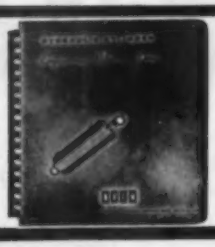
BHEW custom-built hydraulic cylinders give dependable operational performance wherever they are used. These efficient, close-tolerance cylinders require minimum mounting space; their cost is reasonable; there is no charge for tooling. BHEW builds cylinders to meet your specifications, delivers them on schedule.

BHEW CYLINDER FEATURES:

Standard and special designs available. • Double or single acting and telescopic. • 1½" to 8" bore. • Strokes up to 156". • Smallest possible O. D. and retracted O. A. length. • Oil cylinders with 1,500 psi or 3,000 psi working pressure, pneumatic up to 150 psi. • Cup-type, ring-type or O-ring construction. • Choice of mounting.

1. Honed steel cylinder.
2. Full double-sealing "U" cup packing.

Furnished in a wide variety of mountings and anchor brackets.



WRITE for your copy of Hydraulic Cylinder Engineering Reference Data Manual. Can save you hours of time in specifying cylinders. 40 dimensioned basic designs for general and special purpose double acting cylinders.

BHEW BENTON HARBOR ENGINEERING WORKS, INC.
622 LANGLEY AVENUE • ST. JOSEPH, MICHIGAN

R. B. Scovill has joined the sales force of **Rawdon Meyers Agency,** manufacturers' representatives, Cincinnati, Ohio. They handle filters, pumps, and valves.

Automatic Switch Co., Florham Park, N. J. announced the appointment of three new distributors. They are: **Burns Bros.,** Syracuse, N. Y.; **Industrial Equipment Co. of Huston,** Huston, Texas; and **Electrical Engineering and Equipment Co.,** Des Moines, Iowa.

Vickers, Inc. Detroit, Mich. has announced two new appointments. **Walter L. Flinn** has been promoted to staff director—defense activities, to provide better

Walter L. Flinn Vickers, Inc.

James G. Hanna Vickers, Inc.

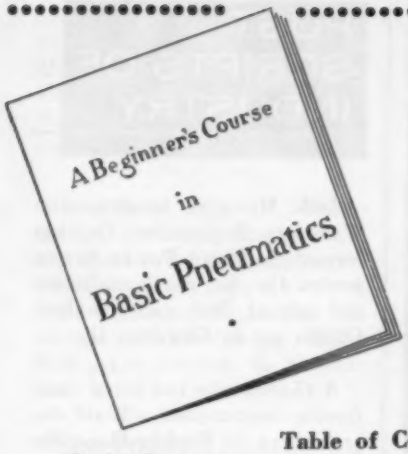
liaison with military establishments. **James G. Hanna** has been appointed district manager of mobile equipment sales for the Chicago area.

Dean Daniels has become western district sales manager for the **Silicone Products Dept., General Electric Co.,** Waterford, N. Y. He is located in the district sales office in Downey, Calif.

The Paul-Munroe Co., Bell Gardens, Calif. has been selected as southern California representative for **The Dukes Co.,** Chicago, Ill.

George M. Ballee has been made vice-president and director of sales for the **Electro-Snap Switch and Mfg. Co.,** Chicago, Ill. He had been sales manager for the past three years.

Continued on page 154



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$1.50 per copy

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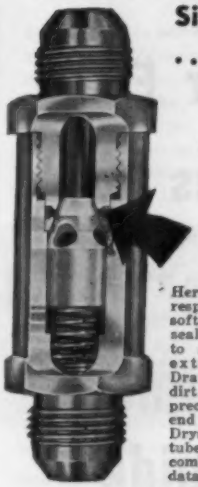

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7321 West 59th Street • Summit, Illinois

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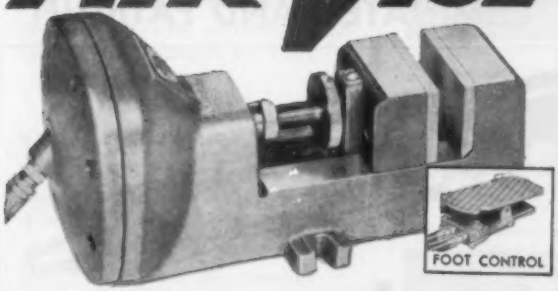
CHECK VALVES
* PATENT APPLIED FOR

Speedy AIR VISE



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AIR TOOLS • AIR VISES • AIR REGULATORS • FILTERS • COMPRESSORS

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Accumulators	Air Motors
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POST SCRIPTS OF INDUSTRY

Jack McGuire formerly with Waterman Engineering Co. has formed the **Fluid Power Accessories Co.** for the manufacture and sale of fluid control valves. Offices are in Glenview, Ill.

A 15-man sales task force, functioning coast-to-coast will aid distributors of **Parker-Hannifin Corp.**, Cleveland, Ohio. Members of this task force, made up of key sales personnel with broad experience in the fluid power field, will spend full-time with field distributors. They will assist and coordinate distributor sales and promotional activities, act as advisors in the selection and sale of the company's products to specialized industries and maintain close liaison between distributors, home sales and manufacturing facilities.

UP TO 3.5:1 MECHANICAL ADVANTAGE AUTOMATICALLY!

DOUBLE ACTING
Toggle Linkage Hand Pumps

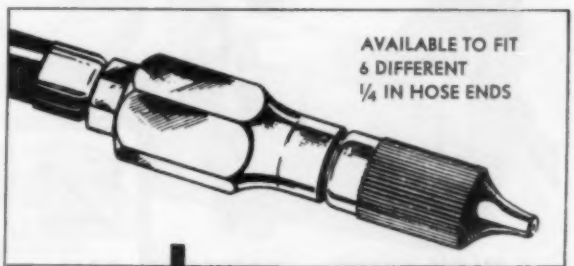
Just select the proper portion of the stroke
Models for 1000, 3000, and 10,000 P.S.I.
Hydraulic pumps, needle valves, 4 and 5 way valves, electric pumps, hydraulic wheels.

Write Dept. AP-5

MECHANISMS CO.
118 E. 2nd St. • Uhrichsville, Ohio

TRU-FLATE® NEW!

"JET" BLOW GUNS
ELIMINATE HAND FATIGUE!



- male pipe threads
- female pipe threads
- quick coupler nipple ends to fit:
- Tru-Flate
- Aro
- Lincoln
- Hansen
- Foster

Write for Bulletin A-3

Adjust for a mere whisper or full capacity quickly and accurately with a slight turn of the nozzle. The "Jet" blow gun gives the right amount of air at the right time and place. No more guessing or tricky valve manipulations to obtain the required amount of air.

TRU-FLATE® INC.
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CIRCLE 77 ON READER SERVICE CARD

CIRCLE 122 ON READER SERVICE CARD

J. N. Smith has been elected to the board of directors of **E. F. Houghton & Co.,** Philadelphia, Pa. At present he is manager of Houghton's hydraulics and transmission department.

Gits Bros. Mfg. Co., Pneumatics Division, Chicago, Ill., has added two distributing organizations. **Barclay, Ayers & Bertsch,** Grand Rapids, for the western half of Michigan. **Geco Sales,** Los Angeles, for California.

John Clem was appointed sales manager of the **Air-Maze Corp.,** Bedford Hts., Ohio. A graduate mechanical engineer, he has been serving as district manager of the company's Chicago office.

John Clem
Air-Maze Corp.

Jay G. Oesterle
Titeflex, Inc.

Jay G. Oesterle was made sales promotion manager of **Titeflex, Inc.,** Springfield, Mass. He will handle sales promotion and other advertising services for industrial and aircraft products.

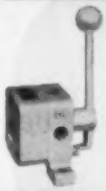
Goshen Rubber Co., Inc., Goshen, Ind., appointed **Carroll D. Hobson** as chief engineer. Hobson, formerly with General Tire and Rubber mechanical goods division, assumes charge of mold design and plant engineering.

Due to increased sales, **Fram Corporation,** Providence, R. I., has enlarged its industrial division. Changes include the appointment of regional industrial sales managers and the formation of a separate sales force to sell the industrial filter line exclusively. The four regional industrial sales managers are: **C. B. Gouert, Jr.,** Oakland, Calif., to direct West

Continued on next page

Ledeen VALVES for longer life

Ledeen Valves are built to operate single or double acting pneumatic and hydraulic cylinders, and motors. These valves embody the rotating disc construction to give the longest possible life. They are built in sizes from ¼" to 1¼" standard pipe connections. Available from stock for quick delivery.



Model HMN
Hand operated to Forward and Reverse. Manual Return to Neutral. 30° throw each way. 60° total throw. Rated at 250 psi.

Model HSN
Hand operated to Forward and Reverse. Spring Return to Neutral. 30° throw each way. 60° total throw. Rated at 100 psi.

Model HSR
Hand operated to Forward. Spring Return to Reverse. No stop in Neutral position. 60° total throw. Rated at 100 psi.

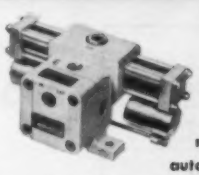
Model FFN
Foot operated to Forward and Reverse by depressing proper pedal to extreme position. Foot Return to Neutral. 15° throw each way. 30° total throw. Rated at 250 psi.

Model FSN
Foot operated to Forward and Reverse by depressing proper pedal to extreme position. Spring Return to Neutral. 15° throw each way. 30° total throw. Rated at 100 psi.

Model FSR
Foot operated to Forward. Spring Return to Reverse. No stop in Neutral position. 30° total throw. Rated at 100 psi.

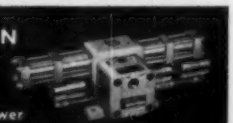
Model POR
Power operated to Forward or Reverse. No Neutral position. Total throw 60°. Rated at 250 psi.

Model PON
Power operated to Neutral, Forward and Reverse. Total throw 60°. Rated at 250 psi.



Model POR
SOLENOID OPERATED 2-position, Power Valve for remote control or automatic operation. Momentary or continuous energizing.

Model PON
SOLENOID OPERATED 3-position Power Valve for remote control or automatic operation. Momentary or continuous energizing.



Time Delay Valve
Pneumatic Time Delay Valve. Adjustable from 2 seconds to 2 minutes. Available in POR and PON Models.

Pilot Valves

3-way Finger, Cam, Air and Solenoid operated models available in Normally Open and Normally Closed types.

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3332 North Gilman Road
El Monte, California

VALVES • CYLINDERS • VALVE ACTUATORS
AIR-HYDRAULIC PUMPS AND BOOSTERS

CHECK VALVE PRICES NOW REDUCED

We have reduced the price of our regular Waterman Check Valve. Tell us your requirements to-day and take advantage of this price reduction.

These check valves are 3000 PSI operating pressure for oil, air or water.

They are of one piece construction—no welds or brazes to crack.

Nylon poppet assures trouble-free service.

Aluminum body and nylon poppets reduce the weight.

They afford minimum pressure loss through valve at rated flow.

ORDERING DATA	
MODEL NO.	PIPE SIZE
345-3	3/8" NPT
345-4	1/2" NPT
345-6	3/4" NPT
345-8	1" NPT

WRITE FOR BULLETIN 5.01

WATERMAN
ENGINEERING COMPANY
725 CUSTER AVENUE EVANSTON, ILLINOIS

POST SCRIPTS OF INDUSTRY

Coast sales from Seattle to San Diego. **P. S. Innis,** Shreveport, La., will cover territory from New Orleans through Oklahoma and Texas. **C. N. Haskins,** Park Ridge, Ill., will direct sales in Illinois, Indiana and Ohio. **J. S. Evans,** Metuchen, N. J., will be responsible for New England, New York, New Jersey and Pennsylvania.

The Valv-Trol Company have moved their plant and offices to new and larger quarters at 1248 Main Street, P. O. Box 2, Cuyahoga Falls, Ohio.

Kenneth H. Meyer has been elected vice president of **C. B. Hunt & Son, Inc.,** Salem, Ohio. Meyer joined the company in 1954 as assistant chief engineer, and became director of engineering in 1957.

Kenneth H. Meyer
C. B. Hunt & Son, Inc.

B. H. Alstad
Parker-Hannifin Corp.

B. H. Alstad has become sales engineer in the Texas-Oklahoma-Louisiana-Arkansas district for **Parker-Hannifin Corporation's** tube and hose fittings, hydraulic accumulators and check valves. Prior to his new appointment, Alstad was sales manager of Riverside Tool Co.

Promotion of **E. S. Saloum** to chief engineer of **Snap-Tite, Inc.,** Union City, Pa., was announced. Saloum is responsible for development, design and testing of the company's line of special purpose quick-connect couplings.

Continued on page 158

1958 FLUID POWER PRIZE PAPER CONTEST

for

Articles About: Hydraulic and Pneumatic Systems and Components

DESIGN . APPLICATION . MAINTENANCE

6th Annual Competition

First Prize	$500
Second Prize	$300
Third Prize	$200
4th to 7th Prizes, each	$50

All prize papers will be published in APPLIED HYDRAULICS Magazine. Papers receiving honorable mention awards will also be published during 1959 and paid for at regular rates.

CONTEST CLOSES JULY 1, 1958

Committee of Judges:

Morton M. Coker, Staff Engineer
Caterpillar Tractor Co., Peoria, Ill.

George R. Keller, Group Leader, Flight Control Engineering Dept. Autonetics, A Division of North American Aviation, Inc. Downey, Calif.

Clifford G. Menard, Chief Engineer
The Heald Machine Co., Worcester, Mass.

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Autonetics, A Division of
North American Aviation

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APPLIED HYDRAULICS Magazine

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- **Design of system components including actuators, valves, pumps, accumulators, transmission lines and seals is discussed. Accumulator theory is presented with a detailed example of proper accumulator selection.**

- **Hydraulic servo systems are diagrammed and the transfer functions developed. Fundamentals of transient analysis technique and frequency response method of servo testing are given. The chapter on high temperature hydraulics outlines present progress in fluids, seals, springs, metals, and other critical components, and indicates future developments and techniques.**

The advance of industrial hydraulics in servo components and systems makes this book of great value to designers of industrial equipment as well as aircraft engineers.

$4.50

10 or more $4.00 per copy

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812 Huron Road • Cleveland 15, Ohio

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☐ Bill me (order no. ———) ☐ Money order attached

NAME .....

ADDRESS..... CITY..... STATE.....

POST SCRIPTS OF INDUSTRY

Denison Engineering Division, American Brake Shoe Co., Columbus, Ohio, made these appointments: **Don Arnold,** promoted to manager of the Detroit District office at Birmingham, Mich. **John W. Lindsay,** to

Don Arnold
Denison Engr. Div.

John W. Lindsay
Denison Engr. Div.

Cleveland District manager. **Howard R. Brumleve** and **David R. Clague** were assigned to the Cleveland District office, as field engineer and sales representative respectively, for the pump and control division. **Lawrence M. Krebs** was assigned to the Detroit office as field engineer for the multipress division.

New plant and laboratory facilities, which will expand its manufacturing potential for the Detroit market, have been opened by **E. F. Houghton & Co.** The new addition, to the original plant, more than doubles the plant size. 24-hour delivery on standard volume products in the Detroit area is the company's objective.

The name of Bendix-Skinner Division of Bendix Aviation Corporation, Madison Heights, Michigan, was changed to **Bendix Filter Division.** The division's West Coast Poroloy Equipment, Inc., Van Nuys, Calif., plant will be designated as the West Coast Branch of the Bendix Filter Division.

Wesley A. Krueger, for the past three years the **Rucker Company's** senior Los Angeles field engineer has been assigned

to the Oakland home office. He will head up the Northern California field engineering force. Robert Cameron was transferred to the firm's Seattle sales office.

Sun Oil Company, Philadelphia, Pa., promoted **William M. Schmitt** to general manager of advertising. **William B. Daub** was named advertising manager for Industrial Products. Daub joined the company in 1945 as a technical writer in the advertising department. He has been assistant advertising manager for Industrial Products since August 1952.

George H. Giesler was appointed sales representative of **Fulton Sylphon Division, Robertshaw-Fulton Controls Company.** Giesler will handle sales in Nashville, Knoxville, Chattanooga and parts of lower Kentucky and western North Carolina.

The Char-Lynn Company, Minneapolis, Minn., has opened a new district office in Davenport, Iowa. It will handle only O.E.M. accounts located in Iowa and Western Illinois. **Harley Bergren** is manager of this new office.

Harley Bergren
Char-Lynn Company

George E. Davies
Eastern Industries

George E. Davies, for the last four years a sales engineer at **Eastern Industries,** Hamden, Conn., was named New England district sales manager of the company's pump division. He will locate in Wellesley, Mass.

B. W. Rogers Co., Akron and Cleveland, Ohio, has been named distributor for **Crown Div., Hannifin Co., a Division of Parker-Hannifin Corp.** Stocks will be maintained at both locations for prompt servicing of customers throughout Northeastern Ohio.

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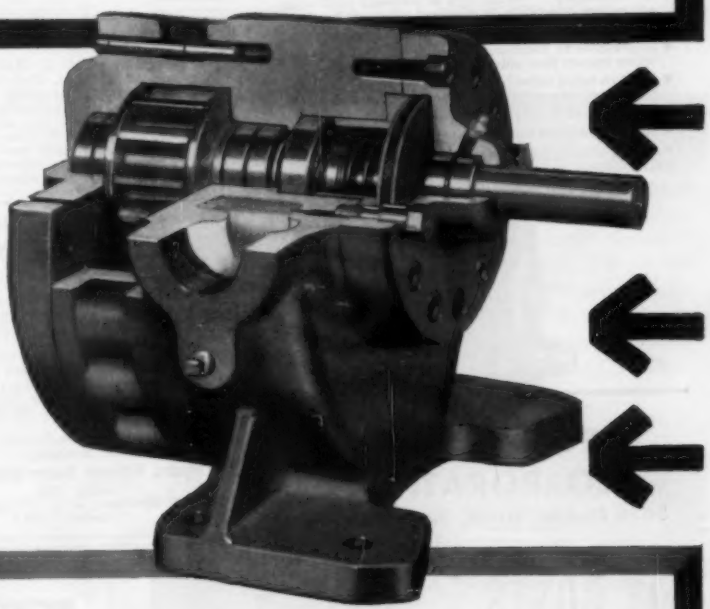

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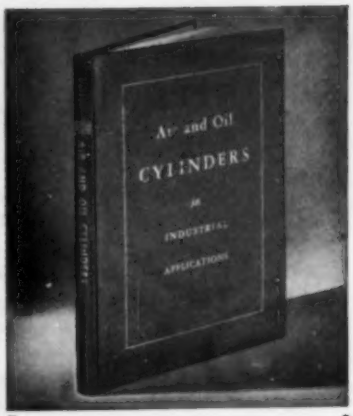

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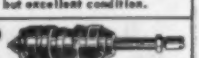

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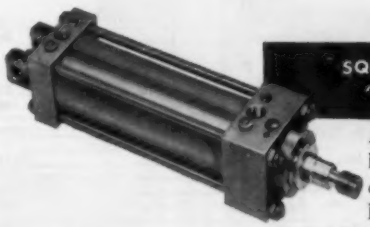

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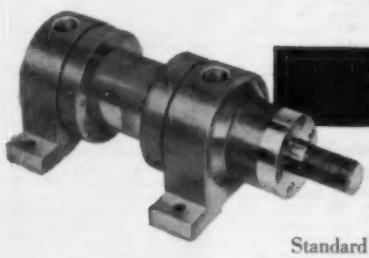

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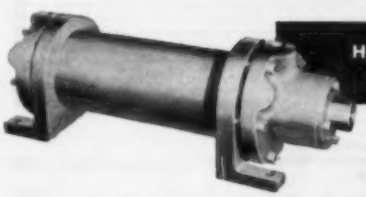

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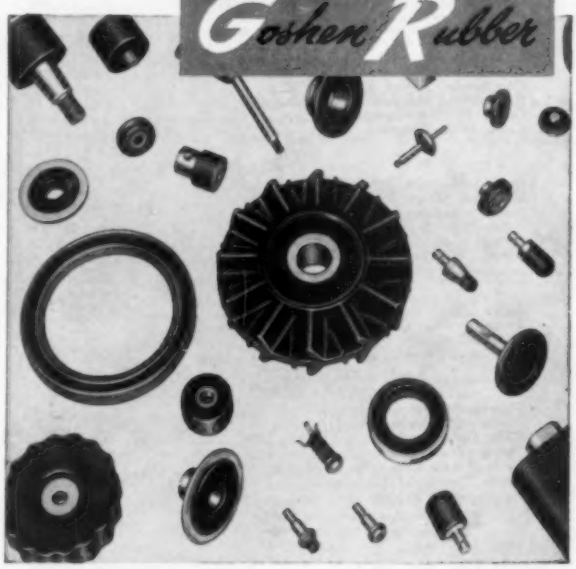

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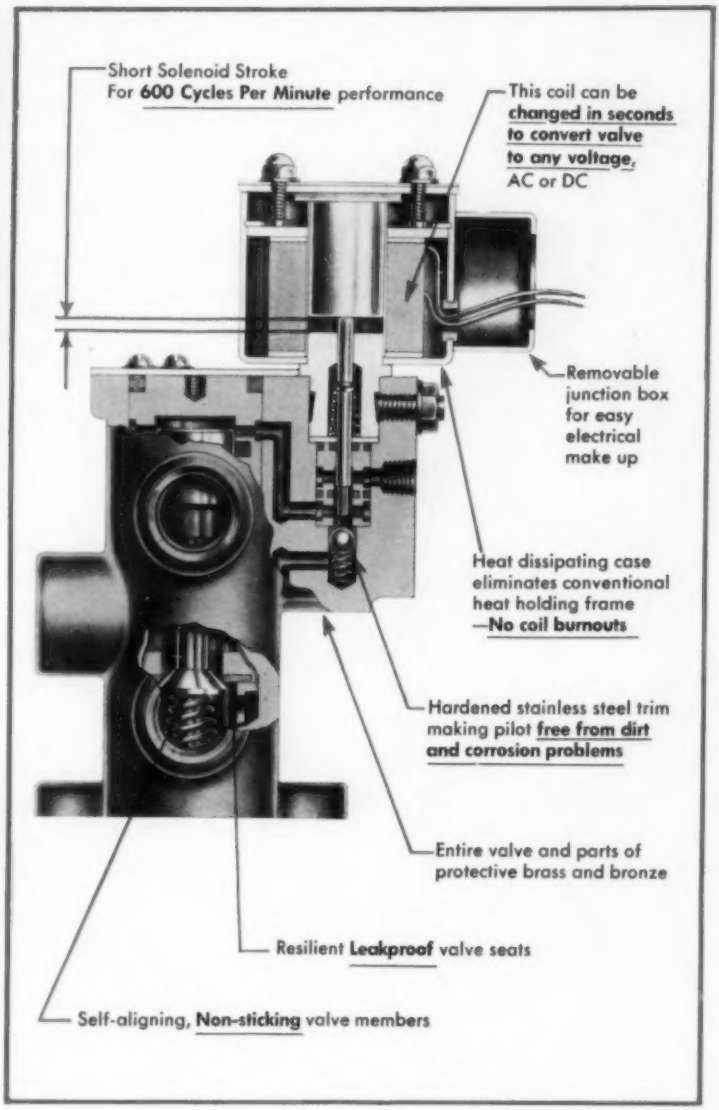
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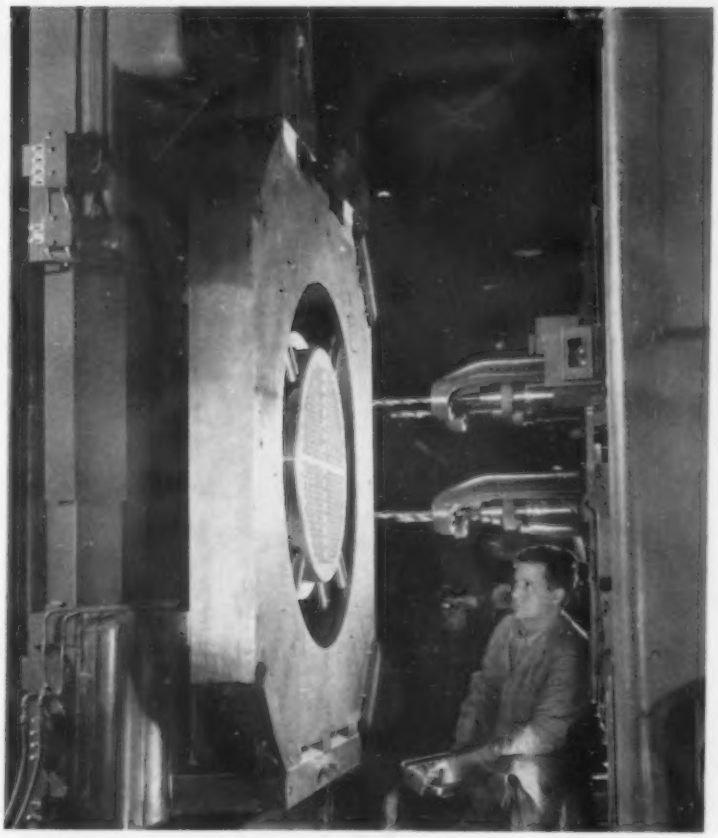
Applied Hydraulics for July

FLUID POWER APPLICATIONS ON MACHINE TOOLS



The July, 1958 issue of APPLIED HYDRAULICS will emphasize fluid power applications on machine tools. Here are the hydraulic and pneumatic design ideas to be presented in the July issue . . . in addition to the regular departments:

SPEED CONTROL . . . several articles will analyze feed circuits on thread millers, transfer devices, honing and drilling machines.

SERVO DESIGN . . . tracer developments on standard machine tools will describe component selection and operation.

CLAMPING, INDEXING AND POSITIONING . . . vital operations on automatic machinery are powered with air and oil, and controlled electrically. Articles authored by design engineers at Snyder Tool, National Acme, Barnes Drill, Leland Gifford, Mercury Engineering, and Baldwin-Lima-Hamilton will tell how practical circuits have been developed.

Advertise in the July issue where reader interest will be stimulated by APPLIED HYDRAULICS' coverage of fluid power in the machine tool field.

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